FACT SHEET

NPDES Permit Number: ID-000022-1
Public Notice Start Date: **February 1, 2000**
Public Notice Expiration Date: **April 3, 2000**

The United States Environmental Protection Agency (EPA) proposes to re-issue a National Pollutant Discharge Elimination System (NPDES) permit to:

FMC Corporation
Phosphorus Chemicals Division
P.O. Box 4111
Pocatello, Idaho 83205

and requests the state of Idaho to certify this NPDES permit pursuant to 40 CFR Part 124.53.

NPDES Permit Re-Issuance

EPA proposes to re-issue an NPDES permit to the FMC Corporation. The draft permit places conditions on the discharge of pollutants from the phosphorus production plant waste water to the **Portneuf River** pursuant to the provisions of the Clean Water Act (CWA). EPA released the original draft of this permit for public review in August 1999. EPA has revised the draft permit and fact sheet based upon new information and determined the changes were substantive enough to re-open the public comment period.

This Fact Sheet includes:

- information on public comment, public hearing and appeal procedures;
- a description of the current discharge;
- a listing of past and proposed effluent limitations, schedules of compliance and other conditions;
- a map and description of the wastewater discharge; and
- detailed technical material supporting the conditions in the permit.

Idaho State Certification

EPA requests the Idaho Division of Environmental Quality to certify the NPDES permit for the FMC Corporation, under section 401 of the CWA.

Public Comment

Persons wishing to comment on the proposed permit may do so in writing by the expiration date of the Public Notice. Persons wishing to submit comments, orally or in writing, may do so at the public hearings scheduled to occur on March 29, 2000 from 6:00pm - 8:00 p.m. at the Fort Hall Reservation [location to be determined] and March 30, 2000 from 6:00pm - 8:00 p.m. at the Cavannaugh's Pocatello Hotel, 1555 Pocatello Creek Road. A question and answer session will be held on both days prior to the hearing.

If no substantive comments are received, the tentative conditions in the draft permit will become final, and the permit will become effective upon issuance. If comments are received, EPA will address the comments and issue the permit. The permit will become effective 30 days after the issuance date, unless a request for an evidentiary hearing is submitted within 30 days.

Availability of Documents

The draft NPDES permit and other related documents can be obtained or reviewed by visiting or contacting EPA's Regional Office in Seattle between 8:30 a.m. and 4:00 p.m., Monday through Friday (See address below). Draft permits, Fact Sheets, and other information can also be found by visiting the Region 10 website at www.epa.gov/r10earth/water.htm.

United States Environmental Protection Agency (EPA)
Region 10
Park Place Building, 13th Floor
1200 Sixth Avenue, OW-130
Seattle, Washington 98101
(206) 553-1214 or
1-800-424-4372

This material is also available from:

United States Environmental Protection Agency (EPA)
Idaho Operations Office
1435 North Orchard Street
Boise, Idaho 83706
(208)378-5746

Idaho State University Library
Government Documents Department
850 South 9th Avenue
Pocatello, Idaho

Shoshone-Bannock Library
Pima and Bannock Roads
Fort Hall, Idaho

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ACRONYMS

BMP	Best Management Practice
BOD	Biochemical Oxygen Demand
EC	Degrees Celsius
CFR	Code of Federal Regulations
cfs	Cubic feet per second
COD	Chemical Oxygen Demand
CV	Coefficient of variation
CWA	Clean Water Act
DMR	Discharge Monitoring Report
DO	Dissolved Oxygen
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
gpm	Gallons per minute
HUC	Hydrologic unit code
IDAPA	Idaho Administrative Procedures Act
IDEQ	Idaho Division of Environmental Quality
IWW	Industrial waste water
lbs/day	Pounds per day
km	kilometer
m	meter
MDL	Method Detection Limit
mgd	million gallons per day
mg/L	Milligrams per liter
ML	Minimum Level
N	Nitrogen
ng/L	nanograms per liter
NMFS	National Marine Fisheries Service
NOEC	No observed effect concentration
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric turbidity units
OW	Office of Water
P	Phosphorus
P4	Elemental phosphorus
pCi/L	Picocurries per liter
PO_4	Orthophosphate
QA	Quality assurance
QAPP	Quality Assurance Project Plan
RCRA	Resource Recovery Conservation Act
RI	Remedial investigation
RI/FS	Remedial investigation feasibility study
RWC	Receiving water concentration
TIN	Total inorganic nitrogen

TMDL	Total Maximum Daily Load
TPH	Total petroleum hydrocarbons
TRI	Toxics reduction inventory
TSS	Total Suspended Solids
TU_c	Chronic Toxic Units
µg/L	Micrograms per liter
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Service
WAD	Weak acid dissociable
WET	Whole Effluent Toxicity
WLA	Waste Load Allocation
WQBEL	Water quality based effluent limit
WWTP	Waste water treatment plant

I. BACKGROUND

A. Applicant

FMC Corporation
Phosphorus Chemicals Division

Facility Location:
Highway 30 West of Pocatello, Idaho

Mailing Address:
P.O. Box 4111
Pocatello, Idaho 83202

Facility Contact:
David Buttelman, HS&E Manager
(208)236-8635

B. Activity

The FMC Corporation Elemental Phosphorus Plant (FMC) is located approximately 3 miles (4.8 km) northwest of Pocatello, Idaho and 1 mile (1.6 km) southwest of the Portneuf River, a tributary of the Snake River. The majority of the site (including most of the processing areas) is located on the eastern portion of the Fort Hall Indian Reservation. FMC Corporation owns approximately 1,500 acres of property. There are several small parcels of property owned by FMC Corporation to the north of Highway 30, but these parcels do not include any processing activities or discharge of waste waters. The commercial product produced at the FMC facility is elemental phosphorus, known chemically as P4.

Details about the manufacturing process are discussed in Appendix A Section I and a map showing the location of the facility is located in Appendix B.

C. Discharge

The FMC effluent will be discharged to the Portneuf River through outfall 001, located at latitude 42E54’44” and longitude 112E31’10”. The facility has an average annual flow of 2.27 million gallons per day (mgd) with a peak flow of 3.02 mgd.

The operations that contribute wastewater to the effluent being discharged from outfall 001 includes: noncontact cooling water from bearing case cooling in briquetting process, beam cooling and fan bearing cooling in calcining process, and furnace cooling (1771 gpm); boiler system blowdown (8 gpm); and steam condensate from phos dock operations (21 gpm). Noncontact cooling water consists primarily of groundwater drawn from onsite production wells (FMC-1 and FMC-3). By design, cooling water does not come into contact with the materials being processed in the calciner and furnaces. Therefore, this noncontact cooling water should not contain process-related pollutants that are not present in groundwater. Analysis of samples collected during Phase I remedial investigation (RI) sampling (Bechtel, 1994) however, show elevated levels of process-related parameters.

Boiler blowdown water is considered process water because the water is used for auxiliary operations in the plant manufacturing process. Even though these waters do not come into contact with process products or reactants, they are still highly concentrated in metals (especially hexavalent chromium and iron) and other pollutants (e.g., hardness, alkalinity, etc.).

The wastewater streams that comprise the effluent discharge are diverted to the Industrial Waste Water (IWW) basin where they are cooled by aeration. The IWW basin is 131 feet (40 m) by 102 feet (31m), and 4 feet 6 inches deep (1.4 m). Wastewater from this unit is either sent back to the plant for reuse, or discharged to the Portneuf River via outfall 001. The ditch that conveys the wastewater from the basin to the river is approximately 1,700 feet (518 m) long, and averages about 6 feet (1.8 m) in width and 3 feet (0.9 m) in depth. The ditch exits FMC's property at the northeast corner through a culvert under adjoining J.R. Simplot property. Both the basin and the ditch are unlined.

The remedial investigation feasibility study (RI/FS) Phase I samples collected from the FMC industrial outfall indicated elevated levels of site-related constituents that were not detected in Phase II samples (Bechtel, 1994). Portneuf River sediments collected at the FMC outfall during Phase I and Phase II contained particles of phosphate ore and precipitator dust or phossy waste solids. These were not found in Portneuf River sediments downstream of the FMC outfall.

Details about the management of water are discussed in Appendix A Section II and a map showing the location of the outfall is located in Appendix B.

D. Permit History

Date	**Action**
September 21,1973	Initial permit issuance - contained limits for total phosphorus, suspended solids, fluoride, pH, temperature, and flow. Required the facility to separate process water from the discharged effluent by October 1, 1975 Expiration date: June 30, 1977.
August 19, 1977	Permit re-issuance. Maximum effluent flow limit had been decreased from 3.2 mgd to 2.44 mgd. Modification of pH range was changed from 6.5-9.0 to 6.0-9.0. Maximum effluent temperature was increased from 92EF to 96EF. Daily average phosphorus limits were decreased from 52.2 kg/day to 38.6 kg/day and average daily limits were decreased from 95.7 kg/day to 64.7 kg/day. The fluoride limit was removed. Expiration date: June 30, 1982.
November 27, 1981	Permittee requested modification to remove flow limits in permit.
December 28, 1981	Permittee requested modification to reduce monitoring frequency requirements for pH and phosphorus.
November 24, 1982	Permit re-issuance. Removed limits for phosphorus, suspended solids, and pH. Added thermal loading limit. Expiration date: November 23, 1987.
September 1, 1994	Application received for permit re-issuance.

E. Plant Performance. A review of the Discharge Monitoring Reports (DMRs) and Compliance Sampling Inspection Reports for the past six years shows that the FMC plant has complied with the terms of the current permit and have reported no violations. Nevertheless, the compliance file indicates several instances of unpermitted releases of pollutants to the NPDES outfall. These instances are as follows:

- On August 22, 1995, process water was discharged as a result of improper pipe connection by contractor for approximately 16 hours.
- On December 19, 1993, process water was discharged as a result of a leak in a furnace sidewall for approximately 2.5 hours.
- On July 20, 1989, process water was discharged as a result of improper pipe connection for approximately 14 hours.
- On February 23 through 25, 1989, storm water (snow melt) was discharged to the outfall.
- On July 3, 1986, process water was discharged as a result of furnace start-up.
- On November 29, 1982, process water was discharged as a result of a plugged process line in furnace spraying into dome cooling water.

These instances of unpermitted discharges indicate that additional monitoring and/or limits need to be imposed on this facility.

II. RECEIVING WATER

A. Description of Portneuf River, Idaho

The Portneuf River is located in the Upper Snake hydrologic basin (HUC 17040208). The river flows from its headwaters at the Portneuf Reservoir (more commonly known as the Chesterfield Reservoir), through the city of Pocatello, Idaho, ultimately joining the American Falls Reservoir. The headwaters are partially located on the Fort Hall Reservation, however, the river flows on state land from the reservoir until approximately two miles downstream of the FMC outfall where it re-enters the Reservation.

The annual flow of the river is characterized by low flows during the summer and fall seasons and peak flows during the winter and spring seasons. The peak flow is due to high precipitation in December and January and winter snowpack melts until May or June. In the summer and fall, low flows are due to agricultural uses drawing from the river.

Permitted point sources of pollution in the lower Portneuf River include the city of Pocatello wastewater treatment plant (WWTP) and the FMC phosphorus production plant. The primary nonpoint sources of pollutants are irrigated crop lands, grazing lands, and springs. Storm water discharge systems and several other discrete sources are included with the more traditional nonpoint sources for loading analysis due to a lack of data and methodology for separate evaluation. No storm water from the FMC industrial facility is discharged to the Portneuf River.

In 1992, the State identified the Portneuf River as water quality limited under 303(d) of the CWA from its headwaters to American Falls Reservoir for bacteria, nutrients, and sediment. Therefore, the state of Idaho was required by the CWA to develop a Total Maximum Daily Loading (TMDL) management plan for the Portneuf River. The State issued a draft TMDL to EPA on November 2, 1998. It is not anticipated that the final TMDL will be issued prior to the issuance of this NPDES permit. Once the TMDL is issued, the TMDL loadings will be incorporated into the permit either by modifying the current permit or at the time of re-issuance.

B. Water Quality

The Idaho water quality standards designate agricultural water supply, cold water biota, salmonid spawning, and secondary contact recreation as beneficial uses for this segment of the Portneuf River. The EPA has stated that the lower Portneuf River and the American Falls Reservoir have had severe water quality problems since 1964 (EPA, 1977) and identified the FMC plant as a contributor to the nutrient and aesthetics impairment of these water bodies.

The Portneuf River is a losing stream (water table is below the elevation of the base of the river) upstream of the FMC outfall and a gaining stream (water table is above the elevation of the base of the river) downstream of the FMC outfall.

In the losing reach, groundwater does not flow into the river and concentration levels of nutrients (ammonia, nitrate, orthophosphate, and total phosphorus), magnesium, potassium, and chloride are lower than average and sodium and sulfate are higher than average (Bechtel, 1994). The pH in the losing reach of the river ranges from 8.2 to 8.7.

In the gaining reach, groundwater flows into the river and/or outfalls at springs which then drain into the river. Samples from the gaining reach has lower than average magnesium, potassium, and chloride concentrations and higher than average nutrients (ammonia, nitrate, orthophosphate, and total phosphorus), sodium, and sulfate concentrations (Bechtel, 1994). The pH in the gaining reach of the river ranges from 7.5 to 8.0.

During Phase I of the RI/FS site characterization study, the river concentrations at the FMC outfall were higher than average for orthophosphate, total phosphorus, nitrate, and fluoride; Ammonia was not detected. Subsequent sampling during Phase II of the RI/FS study indicated that concentrations of these pollutants were consistent with upstream concentrations and the FMC outfall was not affecting the surface water quality at this time.

During the RI/FS study, all Portneuf River sediment samples taken at the mouth of the FMC outfall contained detectable concentrations of cadmium, fluoride, vanadium, zinc, and phosphates.

C. Water Quality Criteria. The following Idaho water quality criteria are applicable to pollutants of concern for the Portneuf River:

IDAPA 16.01.02.051.01	Antidegradation
IDAPA 16.01.02.060	Mixing Zone
IDAPA 16.01.02.200.01	Hazardous Materials
IDAPA 16.01.02.200.02	Toxic Substances
IDAPA 16.01.02.200.03	Deleterious Materials
IDAPA 16.01.02.200.04	Radioactive Materials
IDAPA 16.01.02.200.05	Floating, Suspended, or Submerged Matter
IDAPA 16.01.02.200.06	Excess Nutrients
IDAPA 16.01.02.200.07	Oxygen-Demanding Materials
IDAPA 16.01.02.200.08	Sediment
IDAPA 16.01.02.250.01.c	Secondary Contact Recreation (toxic substance criteria)
IDAPA 16.01.02.250.02.a	Aquatic Life (Hydrogen Ion Concentration (pH), total residual chlorine, dissolved gas, toxic substance criteria)
IDAPA 16.01.02.250.02.c	Cold Water Biota (dissolved oxygen, temperature, ammonia, and turbidity)
IDAPA 16.01.02.250.02.d	Salmonid Spawning (dissolved oxygen, temperature, ammonia)
IDAPA 16.01.02.250.03.b	Agricultural Water Supply
IDAPA 16.01.02.400	Rules Governing Point Source Discharges
IDAPA 16.01.02.400.03	Compliance Schedules
IDAPA 16.01.02.401.03	Treatment Requirements for Point Source Waste waters (temperature, turbidity)

D. Flow

EPA uses the following critical hydrological flows of the receiving water in determining reasonable potential and developing permit limits: the 7Q10 (7 day, 10 year low flow) is used when applying the chronic criterion; the 1Q10 (1 day, 10 year low flow) is used when applying the acute criterion; the 30Q5 (30 day, 5 year low flow) is used when applying the carcinogenic criteria for human health or agriculture; and the harmonic mean is used when applying the non-carcinogenic criteria for human health or agriculture.

The critical flows were determined from the flows recorded at the USGS gaging station (Station #13075500) in Pocatello, Idaho, from 1913 through 1997. The 1Q10 was determined to be 9.94 cfs, the 7Q10 was 17.02 cfs, the 30Q5 was 36.97 cfs, and the harmonic mean was 123 cfs. Between the gaging station and the FMC outfall 001, there are three inputs to the river: Pocatello Creek (15-53 cfs), Trail Creek (0-30 cfs), and Swanson Road Spring (0-8 cfs). Since there is not enough data from any of these sources to compute a 1Q10, 7Q10, 30Q5, or harmonic mean, the lowest flow was used to correct the dilution available for the proposed discharge. Therefore, the critical flows used for reasonable potential analysis and permit limit derivation are:

1Q10:	24.94 cfs
7Q10:	32.02 cfs
30Q5:	51.97 cfs
Harmonic Mean:	135 cfs

For temperature analysis, the flows were divided into tiers and the 7Q10 was developed for each tier. The 7Q10's for each tier are:

Tier I (April 1 through July 31):	17.9 cfs
Tier II (August 1 through September 30):	28.4 cfs
Tier III (October 1 through March 31):	77.4 cfs

E. Mixing Zone

The CWA allows mixing zones at the discretion of the State, therefore, only IDEQ may authorize mixing zones of any size. If the State does not authorize a mixing zone in its 401 certification or authorizes a mixing zone other than the standard mixing zone used to calculate the draft permit limits, the reasonable potential determination and permit limits will be re-calculated for the final permit to ensure compliance with the standards at the point of discharge. At no time is a mixing zone authorized for any pollutant that is water quality limited (i.e., upstream concentration exceeds the water quality criteria).

The Idaho water quality standards for mixing zones in flowing receiving waters allow a standard mixing zone dilution of twenty-five percent (25%) of the receiving water volume to be used in aquatic life calculations and 100% of the receiving water volume to be used in human health and agriculture calculations. The size of the mixing zone is limited to 25% of the stream width, or 300 meters, plus the horizontal length of the diffuser (measured perpendicular to stream flow).

The following pollutants used the standard mixing zone to determine reasonable potential: aluminum, arsenic, boron, cadmium, chromium, chromium (hexavalent), cobalt, copper, cyanide (WAD), fluoride, iron, lithium, manganese, molybdenum, silver, thallium, vanadium, zinc, and some temperature analysis.

III. EFFLUENT LIMITATIONS

Sections 101, 301(b), 304, 308, 401, 402, and 405 of the CWA provide the basis for the effluent limitations and other conditions in the draft permit. The EPA evaluates discharges with respect to these sections of the CWA and the relevant NPDES regulations in determining which conditions to include in the permit.

A. Pollutants of Concern

In the permit application, the FMC Corporation identified the following pollutants as being present in their discharge: strontium (Sr), vanadium (V), uranium (U), bromide (Br), fecal coliform, fluoride (F), nitrate-nitrite as N, total organic nitrogen as N (TON), total phosphorus as P, total alpha radiation, total beta radiation, total radium (Ra), total radium 226 (^{226}Ra), sulfate as SO_4, total barium (Ba), total boron (B), total cobalt (Co), total iron (Fe), total magnesium (Mg), total manganese (Mn), total zinc (Zn), total phenols, biochemical oxygen demand (BOD), total suspended solids (TSS), chemical oxygen demand (COD), ammonia as N, pH, and temperature.

In addition, EPA had reason to believe, by the nature of the effluent and from previous studies by RCRA and Superfund, the following pollutants to be present in the discharge: oil and grease, dissolved oxygen (DO), orthophosphate (PO_4), lead 210 (^{210}Pb), nickel (Ni), elemental phosphorus (P_4), polonium 210 (^{210}Po), radium 228 (^{228}Ra), total dissolved solids (TDS), turbidity, aluminum (Al), antimony (Sb), arsenic (As), beryllium (Be), cadmium (Cd), total chromium (Cr), trivalent chromium (Cr^{+3}), hexavalent chromium (Cr^{+6}), copper (Cu), lead (Pb), lithium (Li), mercury (Hg), molybdenum (Mo), selenium (Se), silver (Ag), thallium (Tl), total cyanide (CN), and total residual chlorine (Cl).

Each of these pollutants will be discussed in section III.E, below. The discussion will include a determination whether there is reasonable potential for violation of water quality standards. Where reasonable potential exists, limits are developed to be incorporated into the permit.

B. Determining Reasonable Potential

In order to determine the need for effluent limits, ambient (upstream) and effluent monitoring data are used in a mass balance equation to determine if the maximum observed effluent concentration has the potential to exceed chemical specific water quality criteria under critical stream conditions. If the projected downstream concentration has the potential to exceed the criteria, then a permit limit is developed for that pollutant.

Pollutants present in the effluent for which the State has not adopted numeric criteria, but which may be contributing to an excursion above a narrative criterion, must also be investigated to determine if permit limits are needed. In such cases, limits are established using one of three options: (1) use EPA's national criteria, (2) develop criteria, or (3) control the pollutant through the use of an indicator. Refer to Appendix C for a more detailed explanation of how reasonable potential is determined.

C. Permit Limit Development

The first step in developing limits is to determine the wasteload allocation (WLA) and the time frame over which the WLAs apply. In general, the period over which a criterion applies is based on the length of time the target organism can be exposed to the pollutant without adverse effect. For example, aquatic life criteria generally apply as one-hour averages (acute criteria) or four-day averages (chronic criteria). Finally, the WLAs are statistically converted to average weekly and monthly average permit limits. In translating the WLA into permit limits, EPA followed the procedures in the Technical Support Document (TSD; EPA, 1991). Refer to Appendix C for a more detailed explanation of permit limit derivation.

Table III-1 presents the FMC phosphorus production plant effluent limitations for the draft permit. For comparison purposes, the table also shows the effluent limitations of the current permit. When converting concentrations to mass loadings, the concentration was multiplied by the peak flow of 3.02 million gallons per day and a conversion factor of 8.34 to obtain the units of pounds per day.

D. Summary of Draft Permit Limitations

TABLE III-1: EFFLUENT LIMITATIONS									
PARAMETER	UNITS	AVERAGE MONTHLY		MAXIMUM DAILY		INSTANTANEOUS MAXIMUM		MINIMUM DAILY	
		CURRENT (1982)	DRAFT (2000)	CURRENT (1982)	DRAFT (2000)	CURRENT (1982)	DRAFT (2000)	CURRENT (1982)	DRAFT (2000)
Ammonia, total as N[1]	µg/L	---	200	---	390	---	---	---	—
	lbs/day	---	5.0	---	10.1	---	---	---	---
Arsenic (As), total[1]	µg/L	---	407	---	816	---	---	---	—
	lbs/day	---	10.4	---	20.9	---	---	---	---
Boron (B), total[1]	mg/L	---	13.6	---	27.3	---	---	---	—
	lbs/day	---	350	---	700	---	---	---	---
Cadmium (Cd), total[1]	µg/L	---	1.48	---	2.96	---	---	---	—
	lbs/day	---	0.04	---	0.08	---	---	---	---
Copper (Cu), total[1]	µg/L	---	17.2	---	34.5	---	---	---	---
	lbs/day	---	0.44	---	0.88	---	---	---	---
Cyanide (WAD)[1]	µg/L	—	11.4	---	22.9	---	---	---	---
	lbs/day	---	0.29	---	0.59	---	---	---	---
Dissolved Oxygen	mg/L	---	---	---	---	---	---	---	6.0
Fluoride (F), total[1]	mg/L	---	0.1	---	0.2	---	---	---	---
	lbs/day	---	2.6	---	5.2	---	---	---	---
Gross Alpha Radiation[1]	pCi/L	---	15	---	30	---	---	---	---
Mercury (Hg), total[1]	ng/L	---	10	---	19	---	---	---	—
	lbs/day	---	0.0003	---	0.0005	---	---	---	---
Orthophosphate as P[1]	µg/L	---	41	---	82	---	---	---	---
	lbs/day	---	1.1	---	2.1	---	---	---	---
pH	s.u.	---	---	---	9.0	---	---	---	6.0
Phosphorus, elemental (P4)[1]	µg/L	---	---	---	---	---	0	---	---
Phosphorus, total as P[1]	µg/L	---	70	---	184	---	---	---	---
	lbs/day	---	1.2	---	3.0	---	---	---	---
Radium-226 + Radium-228[1]	pCi/L	---	5	---	10	---	---	---	---

TABLE III-1: EFFLUENT LIMITATIONS									
PARAMETER	UNITS	AVERAGE MONTHLY		MAXIMUM DAILY		INSTANTANEOUS MAXIMUM		MINIMUM DAILY	
		CURRENT (1982)	DRAFT (2000)	CURRENT (1982)	DRAFT (2000)	CURRENT (1982)	DRAFT (2000)	CURRENT (1982)	DRAFT (2000)
Selenium (Se), total[1, 2]	µg/L	---	4	---	8	---	---	---	---
	lbs/day	---	0.1	---	0.2	---	---	---	---
Silver (Ag), total[1]	µg/L	---	15	---	30	---	---	---	---
	lbs/day	---	0.4	---	0.8	---	---	---	---
Thallium (Tl), total[1]	µg/L	---	185	---	371	---	---	---	—
	lbs/day	---	4.7	---	9.5	---	---	---	---
Temperature[3] (April 1 - Aug 1)	EC	---	---	---	13	---	9	---	—
	BTU/day	---	---	4.39×10^{8}	0	---	---	---	---
Temperature[3] (Aug 2 - Sep 30)	EC	---	---	---	19	---	23	---	---
	BTU/day	---	---	4.39×10^{8}	3.8×10^{8}	—	---	---	---
Temperature[3] (Oct 1 - Mar 31)	EC	---	---	---	17	---	17	---	---
	BTU/day	---	---	4.39×10^{8}	6.5×10^{8}	—	---	---	---
Zinc (Zn), total[1]	µg/L	---	223	---	448	---	---	---	---
	lbs/day	---	5.7	---	11.5	---	---	---	—

1 Reporting to EPA and the local district health office is required within 24-hours if the maximum daily limit is violated.
2 Shall be below quantification level (ML) prior to discharge based upon the EPA approved method 270.2. Final compliance evaluation limit is 5 µg/L (0.1 lbs/day).
3 Thermal loading shall be computed using the following formula:
[flow (gal/day)]x[8.345 (lb/gal)]x[effluent temperature (EF)-receiving water temperature (EF)]
or
[flow (gal/day)]x[8.345 (lb/gal)]x[effluent temperature (EC)-receiving water temperature (EC)]x1.8

E. Evaluation of Effluent Limitations

1. Biochemical Oxygen Demand. The Idaho water quality standards do not specifically state a maximum receiving water concentration for BOD, however, the State standard does require that surface waters of the United States within Idaho shall be free from oxygen-demanding materials in concentrations that would result in an anaerobic water condition.

BOD is a measure of the amount of oxygen required to stabilize organic matter in wastewater. As such, BOD is an equivalent indicator rather than a true physical or chemical substance. It measures the total concentration of dissolved oxygen that would eventually be demanded as wastewater degrades the stream.

Since the dissolved oxygen data indicates that Idaho water quality standards have not been violated nor have the potential to violate (See discussion on Dissolved Oxygen) and COD is a more precise and accurate method of measuring oxygen demand (See discussion on Chemical Oxygen Demand), no limit or monitoring for BOD is imposed on the facility.

No limit for BOD is proposed in the draft permit.

2. Chemical Oxygen Demand (COD). The Idaho water quality standards do not specifically state a maximum receiving water concentration for COD, however, the State standard does require that surface waters of the United States within Idaho shall be free from oxygen-demanding materials in concentrations that would result in an anaerobic water condition.

Organic and some inorganic compounds can cause an oxygen demand to be exerted in a receiving body of water. Indigenous microorganisms utilize the organic wastes as an energy source and oxidize the organic matter. In doing so, their natural respiratory activity will utilize the dissolved oxygen.

Chemical oxygen demand (COD) is a purely chemical oxidation test devised as an alternate method to the BOD test for estimating the total oxygen demand of waste water. Since the method relies on chemical rather than biological oxidation, it is more precise, accurate, and rapid than the BOD test. The COD test is widely used to estimate the total oxygen demand (ultimate rather than 5-day BOD) to oxidize the compounds in waste water. It is based on the fact that organic compounds, with a few exceptions, can be oxidized by strong chemical oxidizing agents under acid conditions with the assistance of certain inorganic catalysts.

The COD test measures the oxygen demand of compounds that are biologically degradable and of many that are not. Pollutants that are measured by the BOD_5 test will be measured by the DOC test. In addition, pollutants that are more resistant to biological oxidation will also be measured as COD. COD is a more inclusive measure of oxygen demand than is BOD_5 and will result in higher oxygen demand values than will the BOD_5 test.

The compounds that are more resistant to biological oxidation are becoming of greater concern, not only because of their slow but continuing oxygen demand on the resources of the receiving water, but also because of their potential health effects on aquatic life and humans. Many of these compounds result from industrial discharges, and some have been found to have carcinogenic, mutagenic, and similar adverse effects, either singly or in combination. Concern about these compounds has increased as a result of demonstrations that their long life in receiving waters - the result of a slow biochemical oxidation rate - allows them to contaminate downstream water intakes. The commonly used systems of water purification are not effective in removing these types of materials, and methods of disinfection, such as chlorination, may convert them into even more hazardous materials.

Since the dissolved oxygen data available indicates that Idaho water quality standards have not been violated nor have the potential for violation, no limit for COD is imposed on the facility. However, the COD test measures organic matter that exerts an oxygen demand and that may affect the health of the people. It is a useful analytical tool for pollution control activities. It also provides a more rapid measurement of the oxygen demand and an estimate of organic compounds that are to measured in the BOD_5 test. Therefore, monitoring of COD is proposed in the draft permit.

No limit for COD is proposed in the draft permit.

3. Chlorine. The Idaho water quality standards require no toxics in toxic amounts. Chlorine compounds in the effluent can be toxic to aquatic life. The water quality criteria for aquatic life requires an acute maximum receiving water concentration of 19 µg/L and a chronic maximum receiving water concentration of 11 µg/L. These levels of monitoring are not available using current approved EPA methods under 40 CFR 136; the lowest method detection limit[1] (MDL) for total residual chlorine is 100 µg/L (Method 330.4).

   An analysis was performed to determine if this pollutant had reasonable potential to violate water quality standards. Since reasonable potential was determined, a limit would normally be imposed on the effluent. However, the data (see Appendix C) indicate very high concentrations of residual chlorine in the receiving water upstream of the facility, which seems unlikely since residual chlorine tends to dissociate rapidly to trihalomethanes and there were approximately two hours between sample collection and sample analysis. Additionally, the laboratory reported very low detection levels (<10 µg/L) which is ten (10) times lower than the method detection level.

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[1]The method detection limit is the minimum concentration that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero.

Since there is no way to reproduce the analysis and no QA was performed, it is difficult to draw conclusions from this data. It seems likely that the samples were somehow contaminated, but this determination cannot currently be substantiated. Since the data are questionable and the reasonable potential analysis is inconclusive, more monitoring for this parameter is required.

This parameter has a very short holding time for analysis and field analysis is generally preferred. Therefore, the draft permit is proposing that the permittee perform field analysis tests. (Field analysis test kits are available from laboratories.)

No limit for chlorine is proposed in the draft permit.

4. Cyanide (Weak Acid Dissociable). The Idaho water quality standards require no toxics in toxic amounts. For WAD cyanide, the water quality criteria for aquatic life requires an acute maximum receiving water concentration of 0.022 mg/L and a chronic maximum receiving water concentration of 0.0052 mg/L. The water quality criterion for human health recreation requires a maximum receiving water concentration of 220 mg/L.

There are no data available for WAD cyanide, however, there are data available for total cyanide. Both WAD and total cyanide measure free cyanide, simple cyanides and weak to moderately strong cyanide complexes. The main difference between total cyanide and WAD cyanide is the measurement of iron cyanide complexes. Since the amount of iron cyanide compounds in the effluent is unknown, it is difficult to know the portion of the measurement that would be present as WAD cyanide in the effluent. However, water quality-based limits can be set for pollutants without facility-specific effluent monitoring data using the available dilution and the water quality criteria for that pollutant as long as the requirements of 40 CFR 122.44(d)(1)(ii) are met (TSD: EPA, 1991).

Under the toxics rule (40 CFR § 131.36), the above criteria apply to total cyanide. A reasonable potential analysis indicated that a limit would be necessary for total cyanide. However, EPA believes that iron cyanides are not an important source of cyanide for the environment and that the measurement of WAD cyanide is adequate in protection of the environment. This is mainly due to the fact that the extreme conditions necessary to break down iron cyanide complexes would not be encountered in natural systems.

The allowed discharge for this facility is noncontact, nonprocess cooling water. Therefore, this pollutant should not be present in the effluent. Of the 11 data points available for total cyanide, two measurements were detected; one at 8µg/L and the other at 15µg/L. This indicates that there is potential for the release of a toxic pollutant that could impact the biota in the receiving water.

The harmful effects of the cyanides on aquatic life are affected by the pH, temperature, dissolved oxygen content, and the concentration of minerals in the water. Data on the acute toxicity of free cyanide (which is only one component of WAD or total cyanide) are available for a wide variety of freshwater species that are involved in diverse community functions. The acute sensitivities ranged from 44.73 µg/L to 2.490 mg/L, but all of the species with acute sensitivities above 400 µg/L were invertebrates. A long-term survival, and a partial and life-cycle test with fish gave chronic values of 13.57, 7.849, and 16.39 µg/L, respectively. Chronic values for two freshwater invertebrate species were 18.33 and 34.06 µg/L. Freshwater plants were affected at cyanide concentrations ranging from 30 µg/L to 26 mg/L (EPA, 1987). Cyanide does not seem to be as toxic to lower forms of life and organisms as it is to fish. The organisms that digest BOD were found to be inhibited at 1.0 mg/L and at 60 mg/L, although the effect is more of a delay in exertion of BOD than total reduction (EPA, 1977).

Since the facility would be limited for total cyanide under the toxics rule, the facility has shown the discharge of a process pollutant, and the facility has shown the discharge of this pollutant in sufficient quantity to pose a toxic impact to the aquatic life, reasonable potential to violate water quality standards was determined for this pollutant. An analysis was performed to determine an appropriate limit for this pollutant for critical conditions present at the outfall (See Appendix C).

The draft permit proposes a maximum daily limit of 22.9 µg/L (0.59 lbs/day) and an average monthly limit of 11.4 µg/L (0.29 lbs/day).

5. Dissolved Oxygen (DO). The Idaho water quality standards require surface waters of the United States within Idaho shall be free from oxygen-demanding materials in concentrations that would result in an anaerobic water condition. The water quality criterion for cold water biota and salmonid spawning has a DO minimum receiving water concentration of 6 mg/L. To ensure that this criterion is met in the river, the permit is proposing that the DO in the discharge remain above the criterion. The data set indicates that the facility will be able to meet this limit.

   The draft permit proposes a minimum daily limit of 6.0 mg/L.

6. Fecal Coliform Bacteria. The water quality criteria for secondary contact recreation require the following maximum receiving water concentrations: 800 colonies per 100 milliliters at any time, 400 colonies per 100 milliliters in more than ten percent of the total samples taken over a thirty-day period, and a geometric mean of 200 colonies per 100 milliliters based on a minimum of five samples taken over a thirty-day period. Data collected from the facility indicate that fecal coliform are present at levels less than 70 colonies per 100 milliliters. These values are consistent with the values of the intake well water and typical of groundwater. Since the facility does not add bacteria in its process and the data set available indicates that Idaho water quality standards have not been violated nor have the potential for violation, no limit for fecal coliform is imposed on the facility.

   No limit for fecal coliform bacteria is proposed in the draft permit.

7. Fluoride (F). The Idaho water quality standards require no toxics in toxic amounts. The water quality criterion for agricultural irrigation requires a maximum receiving water concentration of 15 mg/L (since the soil is alkaline and fine textured) and agricultural livestock requires a maximum receiving water concentration of 2.0 mg/L.

   Fluorine is the most reactive of the nonmetals and is never found free in nature. It is a constituent of fluorite or fluorspar, calcium fluoride, cryolite, and sodium aluminum fluoride. Due to their origins, fluorides in high concentrations are not common constituents of natural surface waters. However, they may occur in hazardous concentrations in ground waters.

   Fluorides found in irrigation waters in high concentrations (up to 360 mg/L) have caused damage to certain plants exposed to these waters. Chronic fluoride poisoning of livestock has been observed in areas where water contained 10 to 15 mg/L fluoride. Concentrations of 30 to 50 mg/L of fluoride in the total ration of dairy cows is considered the upper safe limit. However, as little as 2 mg/L may cause tooth mottling under some circumstances. Fluoride from waters apparently does not accumulate in soft tissue to a significant degree and is transferred to a very small extent into the milk and to a somewhat greater degree into eggs.

Data for fresh water indicate that fluorides are toxic to fish at concentrations higher than 1.5 mg/L and may cause other adverse effects to fish habitats. Concentrations of fluoride above 0.2 mg/L have shown lethal (LC50) effects on and inhibited migration of salmon species.

An analysis was performed to determine if this pollutant had reasonable potential to violate water quality standards (See Appendix C). Since reasonable potential was determined, a limit has been imposed on the effluent. The data set shows that the facility will not be able to comply with these limits and may need to evaluate means of decreasing the pollutant load in their effluent.

The draft permit proposes a maximum daily limit of 0.2 mg/L (5.2 lbs/day) and an average monthly limit of 0.1 mg/L (2.6 lbs/day).

8. Hardness. The Idaho water quality standards do not limit hardness, however, hardness is used in many calculations to determine the toxic effects of some pollutants (e.g., metals). The lower the hardness, the more toxic the pollutant. When a mixing zone is authorized for a pollutant, then a mixed hardness is used to determine the criteria. Otherwise, the receiving water hardness is used. A mixed hardness is determined using the steady state equation (see Appendix C). Hardness is commonly reported as an equivalent concentration of calcium carbonate ($CaCO_3$). Since there are monitoring requirements for parameters that are hardness dependent, hardness is proposed as a monitored parameter in the draft permit.

   No limit for hardness is proposed in the draft permit.

9. Metals. The Idaho water quality standards require no toxics in toxic amounts. Metals in certain concentrations can be toxic to aquatic life, livestock, plant life, and human health. An analysis was conducted on the following metals because existing data indicated their presence in the plant effluent: aluminum, antimony, arsenic, barium, beryllium, boron, bromide, cadmium, chromium, chromium(III), chromium(VI), cobalt, copper, iron, lead, lithium, magnesium, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, thallium, uranium, vanadium, and zinc.

Analysis of the data indicated that aluminum, antimony, barium, beryllium, chromium, chromium(III), chromium(VI), cobalt, iron, lead, lithium, manganese, molybdenum, nickel, and vanadium did not provide a reasonable potential to violate water quality standards (See Appendix C) and limits are not proposed in the draft permit. Water quality criteria are not available for bromide, magnesium, strontium, and uranium, thus, no limits are proposed in the draft permit. Reasonable potential was determined for arsenic, boron, cadmium, copper, mercury, selenium, silver, thallium, and zinc (See discussion below) and, therefore, limits have been imposed on the effluent for these pollutants.

a. Arsenic (As). The water quality criterion for aquatic life requires an acute maximum receiving water concentration of 360 µg/L and a chronic maximum receiving water concentration of 190 µg/L. The water quality criterion for human health recreation requires a maximum receiving water concentration of 50 µg/L. The water quality criterion for agricultural irrigation requires a maximum receiving water concentration of 200 µg/L and agricultural livestock requires a maximum receiving water concentration of 100 µg/L.

   Severe human poisoning can result from injection of as little as 100 mg of arsenic, and less than 130 mg has proven fatal. Arsenic can accumulate in the body faster than it is excreted and can build to toxic levels from the small amounts taken periodically through the respiratory and intestinal walls from air, water, and food.

   An analysis was performed to determine if this pollutant had reasonable potential to violate water quality standards (See Appendix C). Since reasonable potential was determined, a limit has been imposed on the effluent based on the most limiting criterion of chronic aquatic life. The data set shows that the facility will be able to comply with these limits, except during upset conditions.

   The draft permit proposes a maximum daily limit of 816 µg/L (20.9 lbs/day) and an average monthly limit of 407 µg/L (10.4 lbs/day).

b. Barium (Ba). There is no state water quality criterion for barium, however, soluble barium concentrations above 50 mg/L have shown toxicity to aquatic life (EPA, 1986). EPA applied this as a chronic toxicity value and determined this pollutant did not have reasonable potential to violate water quality standards (See

Appendix C). Since the data indicates that Idaho water quality standards have not been violated nor have the potential for violation, no limit for barium is imposed on the facility.

No limit for barium is proposed in the draft permit.

c. Boron (B). The water quality criterion for agricultural irrigation requires a maximum receiving water concentration of 5 mg/L and agricultural livestock requires a maximum receiving water concentration of 0.75 mg/L. An analysis was performed to determine if this pollutant had reasonable potential to violate water quality standards (See Appendix C). Since reasonable potential was determined, a limit has been imposed on the effluent based on the most limiting criterion of agricultural irrigation. The data set shows that the facility will be able to comply with these limits, except during upset conditions.

The draft permit proposes a maximum daily limit of 27.3 mg/L (700 lbs/day) and an average monthly limit of 13.6 mg/L (350 lbs/day).

d. Cadmium (Cd). The water quality criterion for aquatic life requires an acute maximum receiving water concentration of 8 µg/L and a chronic maximum receiving water concentration of 2 µg/L. The water quality criterion for agricultural irrigation requires a maximum receiving water concentration of 10 µg/L and agricultural livestock requires a maximum receiving water concentration of 50 µg/L.

Cadmium is an extremely dangerous cumulative toxicant, causing insidious progressive chronic poisoning in mammals, fish, and probably other animals because the metal is not excreted. Cadmium could form organic compounds that might lead to mutagenic or teratogenic effects. Cadmium is also known to have marked acute and chronic effects on aquatic organisms.

An analysis was performed to determine if this pollutant had reasonable potential to violate water quality standards (See Appendix C). Since reasonable potential was determined, a limit has been imposed on the effluent based on the most limiting criterion of chronic aquatic life. The data set shows that the facility will not be able to comply with the proposed limits and may need to evaluate means of decreasing the pollutant load in their effluent.

The draft permit proposes a maximum daily limit of 2.96 µg/L (0.08 lbs/day) and an average monthly limit of 1.48 µg/L (0.04 lbs/day).

e. Chromium. Even though the water quality standards for chromium have not been shown to violate water quality standards, EPA desires to obtain more information regarding this pollutant and has proposed monitoring of total chromium.

f. Copper (Cu). The water quality criterion for aquatic life requires an acute maximum receiving water concentration of 34 µg/L and a chronic maximum receiving water concentration of 22 µg/L. The water quality criterion for agricultural irrigation requires a maximum receiving water concentration of 200 µg/L and agricultural livestock requires a maximum receiving water concentration of 500 µg/L. An analysis was performed to determine if this pollutant had reasonable potential to violate water quality standards (See Appendix C). Since reasonable potential was determined, a limit has been imposed on the effluent based on the most limiting criterion of acute aquatic life. The data set shows that the facility will be able to comply with these limits, except during upset conditions.

The draft permit proposes a maximum daily limit of 34.5 µg/L (0.88 lbs/day) and an average monthly limit of 17.2 µg/L (0.44 lbs/day).

g. Mercury (Hg). The water quality criterion for aquatic life requires an acute maximum receiving water concentration of 2.0 µg/L and a chronic maximum receiving water concentration of 0.012 µg/L. The water quality criterion for human health recreation requires a maximum receiving water concentration of 0.15 µg/L. The water quality criterion for agricultural livestock requires a maximum receiving water concentration of 10 µg/L.

An analysis was performed to determine if this pollutant had reasonable potential to violate water quality standards (See Appendix C). No dilution was authorized for this pollutant parameter because the U.S. Fish and Wildlife Service indicated that Yellowstone cutthroat trout (*Oncorhynchus clarki bouvieri*) are petitioned for listing under ESA and mercury bioaccumulates and causes toxicity to fish species. Since reasonable potential was determined, a limit has been imposed on the effluent based on the most limiting criterion of chronic aquatic life. The data set shows that the facility will not be able to comply with these limits.

The draft permit proposes a maximum daily limit of 19 ng/L (0.0005 lbs/day) and an average monthly limit of 10 ng/L (0.0003 lbs/day).

h. Selenium (Se). The water quality criterion for aquatic life requires an acute maximum receiving water concentration of 20 µg/L and a chronic maximum receiving water concentration of 5 µg/L. The water quality criterion for agricultural irrigation requires a maximum receiving water concentration of 20 µg/L and agricultural livestock requires a maximum receiving water concentration of 50 µg/L.

An analysis was performed to determine if this pollutant had reasonable potential to violate water quality standards (See Appendix C). No dilution was authorized for this pollutant parameter because the U.S. Fish and Wildlife Service indicated that Yellowstone cutthroat trout (*Oncorhynchus clarki bouvieri*) are petitioned for listing under ESA and selenium bioaccumulates and causes toxicity to fish species. Further, values above 2 µg/L appear to produce adverse effects of some fish and wildlife species (U.S. Department of Interior, 1998) and the Service is concerned that authorization of a mixing zone would increase the potential for accumulation of contaminants from discharges in sediments and in food chain organisms in the Portneuf River and American Falls Reservoir.

Since reasonable potential was determined, a limit has been imposed on the effluent based on the most limiting criterion of chronic aquatic life. The proposed average monthly limit for selenium is below the lowest method quantification level (ML) for approved methods in 40 CFR 136. When effluent limits fall below the ML, EPA Region 10 has adopted guidance in which: 1) the water quality based effluent limits are incorporated into the permit, and 2) the minimum level[2] (ML) will be used as the compliance level. Therefore, 5 µg/L is the final compliance level for selenium. The data set shows that the facility will be able to comply with these limits, except during upset conditions.

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[2]The minimum level (ML) is defined as the lowest concentration that gives recognizable signals and an acceptable calibration point.

The draft permit proposes a maximum daily limit of 8 µg/L (0.2 lb/day) and an average monthly limit of 4 µg/L (0.1 lbs/day). However, the final compliance evaluation level for the average monthly limit will be 5 µg/L (0.1 lbs/day).

i. Silver (Ag). The water quality criterion for aquatic life requires an acute maximum receiving water concentration of 6 µg/L. An analysis was performed to determine if this pollutant had reasonable potential to violate water quality standards (See Appendix C). Since reasonable potential was determined, a limit has been imposed on the effluent based on the most limiting criterion of acute aquatic life. The data set shows that the facility will be able to comply with these limits, except during upset conditions.

The draft permit proposes a maximum daily limit of 30 µg/L (0.8 lb/day) and an average monthly limit of 15 µg/L (0.4 lb/day).

j. Thallium (Tl). The water quality criterion for human health recreation requires an acute maximum receiving water concentration of 6.3 µg/L. An analysis was performed to determine if this pollutant had reasonable potential to violate water quality standards (See Appendix C). Since reasonable potential was determined, a limit has been imposed on the effluent based on the most limiting criterion of human health recreation. The data set shows that the facility will be able to comply with these limits.

The draft permit proposes a maximum daily limit of 371 µg/L (9.5 lb/day) and an average monthly limit of 185 µg/L (4.7 lb/day).

k. Zinc (Zn). The water quality criterion for aquatic life requires an acute maximum receiving water concentration of 149 µg/L and a chronic maximum receiving water concentration of 139 µg/L. The water quality criterion for agricultural irrigation requires a maximum receiving water concentration 2,000 µg/L and agricultural livestock requires a maximum receiving water concentration of 25,000 µg/L.

The toxic release inventory (TRI) data that FMC reported to headquarters indicates that the facility is releasing 645 to 775 pound per year to the Porteuf River through outfall 001. This would equate to average mass loadings of 1.8 to 2.1 pounds per day and average concentrations of 71 to 83 µg/L. These average concentrations would not cause exceedances in the river, however, the true concentrations are more variable than the average (some values will be above the average and some below).

An analysis was performed to determine if this pollutant had reasonable potential to violate water quality standards (See Appendix C). Since reasonable potential was determined, a limit has been imposed on the effluent based on the most limiting criterion of chronic aquatic life. The data set shows that the facility will be able to comply with these limits, except during upset conditions.

The draft permit proposes a maximum daily limit of 448 µg/L (11.5 lb/day) and an average monthly limit of 223 µg/L (5.7 lb/day).

9. Nutrients.

Idaho water quality standards require that surface waters of the United States within Idaho shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses. Nutrients consist of phosphorus, nitrogen and carbon compounds. Nitrogen and phosphorus compounds are particularly harmful since they enhance eutrophication and stimulate undesirable algae growth.

The Portneuf River has been designated as limited for nutrients. The TMDL will address the nutrients of total inorganic nitrogen and total phosphorus and will provide waste load allocations for these pollutants. At present, it is not clear whether nitrogen or phosphorus is a limiting nutrient because concentrations of both elements in the Portneuf River are well above the accepted saturation levels.

Since the TMDL has not been completed, a reasonable potential analysis for nutrients must be evaluated to determine if the discharge is contributing to an excursion above the narrative criterion. EPA's national criteria (Gold Book: EPA, 1986 is used for aquatic life and human health analysis and Blue Book: EPA, 1973 is used for agriculture analysis) are used to determine reasonable potential and establish limits, when necessary.

a. Total Inorganic Nitrogen (TIN). The Idaho water quality standards do not specifically state a maximum receiving water concentration for TIN, however, the State standard does require that surface waters of the United States within Idaho shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses.

TIN is the combination of ammonia, nitrates and nitrites. The proposed target TIN loading for this discharge in the draft TMDL is 0.0 tons per year, which is not realistically achievable with current technology. The proposed target concentration for TIN is 0.3 mg/L, which should be applied to this discharge. FMC's current loading, using the proposed loading limit for ammonia and converting the maximum nitrate+nitrite value (18.4 mg/L) into a loading, results in a TIN loading of 86.4 tons per year. Using the proposed target concentration for TIN from the draft TMDL, FMC's target TIN loading should be 1.4 tons per year. Since there is not an EPA approved method for TIN and TIN is the combination of ammonia, nitrates, and nitrites, no limit for TIN is imposed on the facility. TIN will be regulated through the monitoring of ammonia and nitrate+nitrite.

No limit is proposed for TIN in the draft permit.

b. Ammonia (as Nitrogen). Idaho criteria for ammonia are based on calculations that take into account water temperature and pH. It is EPA policy to use the 95th percentile of temperature and pH data for the receiving water body to determine the criterion for ammonia because ammonia exists in its non-ionized form only at higher pH levels and is most toxic in this state. Therefore, the water quality criterion for aquatic life requires an acute maximum receiving water concentration of 1.33 mg/L and a chronic maximum receiving water concentration of 0.24 mg/L based on a temperature of 20EC and pH of 8.7.

An analysis was performed to determine if this pollutant had reasonable potential to violate water quality standards (See Appendix C). No dilution was authorized for this analysis since the Portneuf River is nutrient limited. Since reasonable potential was determined, a limit has been imposed on the effluent based on the most limiting criterion of chronic aquatic life. Because the maximum value observed was extremely high (288 mg/L), a reasonable potential analysis was also performed on the next lowest number (0.3 mg/L) and the same limits were computed. The data set shows that the facility will not be able to comply with the proposed limits and may need to evaluate means of decreasing the pollutant load in their effluent.

The draft permit proposes a maximum daily limit of 0.39 mg/L (10.1 lb/day) and a monthly average limit of 0.20 mg/L (5.0 lb/day).

c. Nitrate+Nitrite (as Nitrogen). The water quality criterion for agricultural livestock requires a maximum receiving water concentration of 100 mg/L. An analysis was performed to determine if this pollutant had reasonable potential to violate water quality standards (See Appendix C). Since the data indicates that Idaho water quality standards have not been violated nor have the potential for violation, no limit for nitrate+nitrite is imposed on the facility. However, since nitrate+nitrite is part of TIN, monitoring for this parameter in included in the draft permit.

No limit for nitrate+nitrite is proposed in the draft permit.

d. Orthophosphate (PO_4 as Phosphorus). The Idaho water quality standards do not specifically state a maximum receiving water concentration for orthophosphate, however, the State standard does require that surface waters of the United States within Idaho shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses.

Phosphate is the measure of inorganic phosphorus. To prevent the development of biological nuisances and to control accelerated or cultural eutrophication, total phosphates as phosphorus should not exceed 50 µg/L in any stream at the point where it enters any lake or reservoir (EPA, 1987). Since the Portneuf River is impaired for nutrients, this criterion is applied to the permittees effluent at the point of discharge.

An analysis was performed to determine if this pollutant had reasonable potential to violate water quality standards (See Appendix C). No dilution was authorized for this analysis since the Portneuf River is nutrient limited. Since reasonable potential was determined, a limit has been imposed on the effluent based on the most limiting criterion of chronic aquatic life. Because the maximum value observed was extremely high (2210 mg/L), a reasonable potential analysis was also performed on the next lowest number (0.7 mg/L) and the same limits were computed. The data set shows that the facility will be able to comply with the proposed limits, except during upset conditions.

The draft permit proposes a maximum daily limit of 82 µg/L (2.1 lb/day) and an average monthly limit of 41 µg/L (1.1 lb/day).

e. Elemental Phosphorus (P_4). The Idaho water quality standards do not specifically state a maximum receiving water concentration for elemental phosphorus, however, the State standard does require no toxics in toxic amounts. Phosphorus in the elemental form is particularly toxic and is subject to bioaccumulation in much the same way as mercury (EPA, 1987). Colloidal elemental phosphorus will poison marine fish causing skin tissue breakdown and discoloration. Also, phosphorus is capable of being concentrated and will accumulate in organs and soft tissues.

Experiments have shown that marine fish will concentrate phosphorus from water containing as little as 1 µg/L. While elemental phosphorus in sparingly soluble in water (3 ppm), it is toxic to aquatic animals at concentrations well below its solubility limit. Therefore, EPA recommends a criterion of 0.10 µg/L for elemental phosphorus.

Since the effluent is noncontact cooling water, not process water, there is no reason for elemental phosphorus to be present in the discharge. However, there have been past occurrences of process water infiltrating the noncontact cooling water system resulting in unpermitted discharges of elemental phosphorus. Therefore, the draft permit is proposing that the permittee conduct monitoring for this pollutant to ensure that there is no discharge. A trigger point of 0.10 µg/L will be used to initiate an investigation by the permittee.

The draft permit is proposing 0.10 µg/L as a trigger point to initiate an investigation and an instantaneous maximum limit of no discharge.

f. Total Phosphorus as P. The Idaho water quality standards do not specifically state a maximum receiving water concentration for total phosphorus, however, the State standard does require that surface waters of the United States within Idaho shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses.

A desired goal for the prevention of plant nuisances in streams or other flowing waters not discharging directly to lakes or impoundments is 100 µg/L total P (EPA, 1987). Since the

Portneuf River is impaired for nutrients, this criterion is applied to the permittee's effluent at the point of discharge.

An analysis was performed to determine if this pollutant had reasonable potential to violate water quality standards (See Appendix C). No dilution was authorized for this analysis since the Portneuf River is nutrient limited. Since there was only one non-detect, the true CV was calculated for the data. Because the maximum value observed was extremely high (2590 mg/L) causing the data set to be quite variable (CV=5.4), a reasonable potential analysis was also performed on the next lowest number (3.0 mg/L, with a CV of 1.1) and as if no data were available with a CV of 1.1 (a CV of 1.1 was used since it was assumed to be the true variability of the data). The limits were lower for the first analysis and the same for the latter two analyses. Since reasonable potential was determined for all analysis, the higher limit has been imposed on the effluent because it is protective of the criterion at the point of discharge. The data set shows that the facility will not be able to comply with the proposed limits and may need to evaluate means of decreasing the pollutant load in their effluent.

The proposed target total phosphorus loading for this discharge in the draft TMDL is 0.0 tons per year, which is not realistically achievable with current technology. The proposed target concentration for total phosphorus is 0.075 mg/L, which should be applied to this discharge. FMC's current loading, converting the maximum discharge value for total phosphorus (3.0 mg/L) into a loading, results in a total phosphorus loading of 14.0 tons per year. Using the proposed target concentration for total phosphorus from the draft TMDL, FMC's target total phosphorus loading should be 0.5 tons per year.

The draft permit proposes a maximum daily limit of 184 µg/L (3.0 lb/day) and an average monthly limit of 70 µg/L (1.2 lb/day).

10. Oil and Grease. The Idaho water quality standards require surface waters of the state to be free from floating, suspended, or submerged matter of any kind in concentrations causing nuisance or objectionable conditions or that may impair designated beneficial uses. This includes any petroleum products that cause a sheen or coating on the water surface.

EPA staff have noted that wash down operations in the furnace building are discharged through a drain in the basement that is connected to the noncontact cooling water system. The wash down water contains oils and grease that have caused enough trouble that the facility has installed a boom and skimmer to try and contain it. The IDEQ has set a water quality goal of 5 ppm for Total Petroleum Hydrocarbons (TPH) for the Portneuf River in the TMDL proposed to EPA. Since it is unknown how oil and grease are affecting the designated uses at this time, the draft permit proposes that the facility monitor for oil and grease.

The draft permit proposes that the facility meet a narrative standard for floating, suspended or submerged matter.

11. Other Drugs, Chemicals, or Medications. The discharge of any drugs, chemicals, or medications in toxic amounts is prohibited pursuant to Section 101(a)(3) of the CWA and the Idaho water quality standards, which prohibits the discharge of toxic pollutants in toxic amounts.

    The draft permit is proposing that there shall be no discharge of any waste streams, including spills and other unintentional or non-routine discharges of pollutants, that are not part of the normal operation of the facility as disclosed in the permit application, or any pollutants that are not ordinarily present in such waste streams.

12. pH. The Idaho water quality standard for protection of aquatic life gives an allowable pH range of 6.5 to 9.5 standard units. However, pH standards for industrial facilities limits pH to 9.0 standard units. The data set shows that the facility will be able to comply with this standard.

    Knowledge of the pH of water or waste water is useful in determining the concentration of other pollutants in the waste stream. Some metals (such as iron, copper, zinc, cadmium, and lead) tend to dissolve in low pH waters. Additionally, the toxicity of ammonia is a function of pH (ammonia is more lethal with a higher pH) and is a proposed limited parameter for this effluent.

    Extremes of pH or rapid pH changes can exert stress conditions or kill aquatic life outright. Even moderate changes from “acceptable” criteria limits of pH are deleterious to some species. The relative toxicity to aquatic life of many materials is increased by changes in the water pH. Therefore, pH is being included as a proposed monitoring parameter.

    The draft permit proposes a maximum daily limit of 9.0 s.u. and a minimum daily limit of 6.5 s.u.

13. Phenols. The Idaho water quality standards require no toxics in toxic amounts. The water quality criterion for human health recreation requires a maximum receiving water concentration of 4,600 mg/L.

The ingestion of concentrated solution of phenol by humans results in severe pain, renal irritation, shock, and possibly death. A total dose of 1.5 grams may be fatal.

Phenolic compounds may adversely affect fish in two ways: first, by a direct toxic action, and second, by imparting a taste to the fish flesh. The toxicity of phenol towards fish increases as the dissolved oxygen level is diminished, as the temperature is raised, and as the hardness is lessened. Phenol appears to act as a nerve poison causing too much blood to get to the gills and to the heart cavity and is reported to have a toxic threshold of 0.1 to 15 mg/L. Mixed phenolic substances appear to be especially troublesome in imparting taste to fish flesh. Chlorophenol produces a bad taste in fish far below lethal or toxic doses.

An analysis was performed to determine if this pollutant had reasonable potential to violate water quality standards (See Appendix C). Since the data indicates that Idaho water quality standards have not been violated nor have the potential for violation, no limit for phenols is imposed on the facility. However, this determination is based on one data point and EPA would like to acquire more information regarding this parameter. Therefore, monitoring for phenols is proposed in the draft permit.

No limit for phenols is proposed in the draft permit.

14. Radioactivity. The Idaho water quality standards require that radioactive materials or radioactivity not exceed levels required in the federal Standards for Protection Against Radiation (10 CFR Part 20). Even though these regulations are for facilities licensed with the Nuclear Regulatory Commission (NRC), they apply to this facility through citation in Idaho water quality standards. The pollutants of concern are lead-210, polonium-210, radium-226, and radium-228.

Radioactive wastes are similar in many respects to other chemical wastes, except that they emit ionizing radiation. Ionizing radiation, when absorbed in living tissues in quantities substantially above that of natural background levels, is recognized as injurious. It is necessary, therefore, to prevent excessive levels of radiation from reaching any living organism, including humans, fish, and invertebrates.

The biological cycle of radionuclides in the aquatic environment requires plants and animals to accumulate the radionuclide, retain it, be eaten by another organism, and be digestible. However, even if an organism accumulates and retains a radionuclide and is not eaten before it dies, the radionuclide will enter the biological cycle through organisms that decompose the dead organic material into its elemental components. Plants and animals that become radioactive in this biological cycle can thus pose a health hazard when eaten by man.

Aquatic life may receive radiation from radionuclides present in the water and substrate and also from radionuclides that may accumulate within their tissues. Humans can acquire radionuclides through many different pathways; among the most important are through eating fish and shellfish that have concentrated nuclides from the water. Where aquatic life have accumulated radioactive materials are used as food by humans, the concentrations of the nuclides in the water must be further restricted to provide assurance that the total intake of radionuclides from all sources will not exceed the recommended levels.

The main concern with radiation is human exposure to radiation through human consumption of foodstuffs harvested from the Portneuf River. Additionally, the Portneuf River is designated for agricultural use (irrigation of crops and raising of livestock). To protect human consumption of harvested foodstuffs (i.e., fish, crops, livestock), the State standards require that the Federal Drinking Water Standards (40 CFR Part 141) are used in assessing reasonable potential for radioactivity. Therefore, in order to prevent unacceptable doses of radiation from reaching humans, fish, and other important organisms, the concentrations of radionuclides in water must be restricted.

a. Gross Alpha Radiation. The water quality criterion for agricultural irrigation and agricultural livestock requires a maximum receiving water concentration of 15 pCi/L for gross alpha radiation. An analysis was performed to determine if this pollutant had reasonable potential to violate water quality standards (See Appendix C). No dilution was authorized for this analysis since the Portneuf River upstream concentration exceeds the criteria. Since reasonable potential was determined, a limit has been imposed on the effluent based on the most limiting criterion of agricultural irrigation. Because the maximum value observed was extremely high (186.5 pCi/L), a reasonable potential analysis was also performed on the next lowest number (6.71 pCi/L) and no reasonable potential was determined. The data set shows that the facility will be able to comply with these limits, except during upset conditions.

The draft permit proposes a maximum daily limit of 30 pCi/L and an average monthly limit of 15 pCi/L.

b. Radium 226 plus Radium 228. The water quality criterion for agricultural irrigation and agricultural livestock requires a maximum receiving water concentration of 5 pCi/L for radium-226 plus radium-228. An analysis was performed to determine if this pollutant had reasonable potential to violate water quality standards (See Appendix C). No dilution was authorized for this analysis since the Portneuf River upstream concentration exceeds the criteria. Since reasonable potential was determined, a limit has been imposed on the effluent based on the most limiting criterion of agricultural irrigation. The data set shows that the facility will be able to comply with these limits, except during upset conditions.

The draft permit proposes a maximum daily limit of 10 pCi/L and an average monthly limit of 5 pCi/L.

c. Lead-210. The water quality criterion for human health requires a maximum receiving water concentration of 10 pCi/L for lead-210. An analysis was performed to determine if this pollutant had reasonable potential to violate water quality standards (See Appendix C). Since the data indicates that Idaho water quality standards have not been violated nor have the potential for violation, no limit for lead-210 is imposed on the facility.

No limit for lead-210 is proposed in the draft permit.

d. Polonium-210. The water quality criterion for human health requires a maximum receiving water concentration of 40 pCi/L for polonium-210. An analysis was performed to determine if this pollutant had reasonable potential to violate water quality standards (See Appendix C). Since the data indicates that Idaho water quality standards have not been violated nor have the potential for violation, no limit for polonium-210 is imposed on the facility.

No limit for polonium-210 is proposed in the draft permit.

e. Radium-226. The water quality criterion for human health requires a maximum receiving water concentration of 60 pCi/L for radium-226. An analysis was performed to determine if this pollutant had reasonable potential to violate water quality standards (See Appendix C). Since the data indicates that Idaho water quality standards have not been violated nor have the potential for violation, no limit for radium-226 is imposed on the facility.

No limit for radium-226 is proposed in the draft permit.

f. Radium-228. The water quality criterion for human health requires a maximum receiving water concentration of 60 pCi/L for radium-228. An analysis was performed to determine if this pollutant had reasonable potential to violate water quality standards (See Appendix C). Since the data indicates that Idaho water quality standards have not been violated nor have the potential for violation, no limit for radium-228 is imposed on the facility.

No limit for radium-228 is proposed in the draft permit.

15. Solids.

a. Total Dissolved Solids (TDS). The Idaho water quality standards do not specifically state a maximum receiving water concentration for TDS, however, the State standards do require that surface waters of the state shall be free from deleterious materials in concentrations that impair designated beneficial uses.

Total dissolved solids consist of inorganic salts, small amounts of organic matter, and dissolved materials. The principle inorganic anions dissolved in water include the carbonates, chlorides, sulfates, phosphates, and nitrates whereas the principle cations are sodium, potassium, calcium, and magnesium.

Fish species and other aquatic life are tolerant of various ranges of dissolved solids concentration, depending on the species. Studies have shown that several common freshwater species survived in waters with 5,000 to 10,000 mg/L dissolved solids (EPA,1981). Fish can slowly become acclimatized to higher salinities, but fish in waters of low salinity cannot survive sudden exposure to high salinities. Dissolved solids may influence the toxicity of heavy metals and organic compounds to fish and other aquatic life, primarily because of the antagonistic effect of hardness on metals.

Agricultural uses are also limited by excessive dissolved solids concentrations. They can cause harm to plant life because the rapid salinity changes will affect the osmotic effect leading to plasmolysis. Livestock can also be affected when dissolved solid concentrations reach 5,000 mg/L in highly alkaline waters and waters with total dissolved solids over 500 mg/L have decreasing utility as irrigation water.

Since the maximum effluent concentration measured was 3.25 mg/L and the maximum receiving water concentration measured was 404 mg/L, dissolved solids is not a concern for aquatic life, or agricultural livestock and irrigation. Since the maximum concentration in the Portneuf River is below the level for water where no detrimental effects will usually be noticed (500 mg/L), no monitoring for total dissolved solids is proposed in the draft permit.

No limit for total dissolved solids is proposed in the draft permit.

b. Total Suspended Solids (TSS) and Turbidity. The Idaho water quality standards state that sediment shall not exceed quantities which impair designated beneficial uses and require surface waters of the State to be free from floating, suspended, or submerged matter of any kind in concentrations causing nuisance or objectionable conditions or that may impair designated beneficial uses.

Suspended solids are organic and inorganic particulate matter in water. Turbidity of water is related to the amount of suspended and colloidal matter contained in the water. It is a measure of the clearness and penetration of light in water and an indirect measure of suspended solids.

Solids in suspension can be aesthetically displeasing and interfere with recreational use. They may also kill fish by causing abrasive injuries and by clogging the gills and respiratory passages of various aquatic fauna. Indirectly, suspended solids cause adverse effects to aquatic life because they screen out light and promote the development of noxious conditions through oxygen depletion.

Identifiable effects of suspended solids on irrigation use of water include the formation of crusts on top of the soil, the formation of films on plant leaves, and cause interference with irrigation diversion equipment. When suspended solids form crusts on top of the soil, the crust inhibits water infiltration, plant emergence, and soil aeration. The formation of films on plant leaves blocks the sunlight and impedes plant growth.

When suspended solids become settleable, they deposit on the bed of the water body. This can cause damage to the invertebrate populations, block gravel spawning beds, and remove dissolved oxygen from overlying waters.

Suspended solids can also cause near surface wasters to become heated because of the greater heat absorbency of the particulate material. This tends to stabilize the water column and prevent vertical mixing which decreases the dispersion of dissolved oxygen and nutrients to lower portions of the water body.

The water quality criterion for aquatic life states that turbidity shall not exceed background turbidity by more than fifty NTU instantaneously or more than twenty-five NTU for more than ten consecutive days. The water quality criterion for point source discharges states that effluent turbidity below fifty NTU shall not increase the background turbidity by more than five NTU and effluent turbidity above fifty NTU shall not increase the background turbidity by more than ten percent or 25 NTU, whichever is less.

An analysis was performed to determine if this pollutant had reasonable potential to violate water quality standards (See Appendix C). Since the data indicates that Idaho water quality standards have not been violated nor have the potential for violation, no limit for turbidity is imposed on the facility.

The draft permit is proposing that there shall be no discharge of floating solids or visible foam in other than trace amounts. This requirement was a condition of the current permit and will be retained in the proposed permit.

16. Specific Conductance. Specific conductance is a measure of the capacity of water to convey an electric current. This property is related to the total concentration of ionized substances in water and water temperature. Specific conductance is frequently used as a substitute method of quickly estimating the dissolved solids concentration in water. (See Solids, Total Dissolved Solids).

    No limit for specific conductance is proposed in the draft permit.

17. Sulfates. Sulfates are derived from the oxidation of sulfites and can exert chemical oxygen demand on receiving waters. Sulfates are not particularly

harmful, but are a major constituent of the total dissolved solids in waste waters from this industry. (See Solids, Total Dissolved Solids).

No limit for sulfates is proposed in the draft permit.

18. Temperature. Since the nature of this discharge is cooling water, only the effects of heated water will be discussed in this fact sheet. Temperature can be influential in determining which aquatic species are present in a water body. When cold water biota are attracted to heated water in winter months, fish mortality may result when the fish return to cooler waters.

Increased temperature can change reproduction cycles and may inhibit spawning. It can also cause migration of competitors, predators, parasites, and disease that can destroy a species at levels far below those that are lethal. Thus, a fish population may exist in a heated area only by continued immigration.

The water quality criterion for aquatic life requires a maximum daily receiving water temperature of 22EC and an average daily receiving water temperature of 19EC. The water quality criterion for salmonid spawning (Cutthrout Trout identified as present by NMFS) requires a maximum daily receiving water temperature of 13EC and an average daily receiving water temperature of 9EC.

An analysis was performed to determine if this pollutant had reasonable potential to violate water quality standards. The data were split into three tiers to determine if limits were needed for the discharge. Since reasonable potential was determined, a limit has been imposed on the effluent (See Appendix C). The data set shows that the facility will not be able to comply with the proposed limits and may need to evaluate means of decreasing the pollutant load in their effluent. The thermal loading for Tier III is higher than the current limit because the current limit used the annual average flow for the entire year and the flow during Tier III is greater than the annual average flow. Because the flow is higher during Tier III and the river is not impaired during this time frame, a higher dilution is allowable than was used to develop the limits in the current permit.

The draft permit proposes the following limits for temperature:

Tier I (April 1 through July 31): a maximum daily temperature of 9EC (0 BTU/day) and an instantaneous maximum temperature of 13EC,
Tier II (August 1 through September 30): a maximum daily temperature of 19EC (3.8x10^8 BTU/day) and an instantaneous maximum temperature of 23EC, and
Tier III (October 1 through March 31): a maximum daily temperature of 17EC (6.5x10^8 BTU/day) and an instantaneous maximum temperature of 17EC.

19. Whole Effluent Toxicity (WET). Whole effluent toxicity is a useful parameter for assessing and protecting against impacts upon water quality and designated uses caused by the aggregate toxic effect of the discharge of pollutants. The Idaho water quality standards require no toxics in toxic amounts. Even though the State standards do not specifically state a maximum receiving water concentration for WET, EPA recommends that magnitudes for whole effluent toxicity are as follows: for acute protection, the criterion should be set at 0.3 acute toxic unit (TU_a); and for chronic protection, the criterion should be set at 1.0 chronic toxic unit (TU_c).

An analysis was performed to determine if this pollutant had reasonable potential to violate water quality standards (See Appendix C). One data report had an interrupted dose response of 50% (2.0 TU_c), but all others were at 100% (1.0 TU_c). The reasonable potential analysis indicates that there is a potential for violation of water quality standards because a coefficient of variation (CV) of 0.6 was used in the analysis. Whenever there are less than ten data points, it is EPA's policy to use a default CV of 0.6. This CV is indicative of a high variation in the data set, however, the data set did not appear to be that variable. Thus, EPA would like more data concerning this parameter.

The draft permit proposes that quarterly WET testing be conducted in the first year. If no toxicity is present, then quarterly sampling would be conducted in the fourth year. If toxicity is present in the first year, quarterly sampling would be required for the duration of the permit.

F. Antidegradation

In proposing to reissue this permit, EPA has considered Idaho's antidegradation policy. This provision states that "the existing instream water uses and the level of water quality necessary to protect the existing uses will be maintained and protected." This policy is designed to protect existing water quality when the existing quality is better than that required to meet the standard and to prevent water quality from being degraded below the standard when existing quality just meets the standard. The draft permit will result in decreases in the authorized pollutant loadings to Portneuf River. Therefore, the draft permit will not result in degradation of water quality and is consistent with Idaho's antidegradation policy.

G. Compliance Schedules

The State of Idaho allows compliance schedules for point source discharges which allow a discharger to phase-in, over time, compliance with water quality-based effluent limitations when new limitations are in the permit for the first time. Compliance schedules are limited to five years or the life of the permit. If the State does not authorize a compliance schedule in their 401 certification, none will be given in the final permit and compliance with effluent limits will commence on the effective date of the permit. Should the State authorize a compliance schedule, then interim performance-based limits will be imposed on the facility for the duration of the compliance schedule. FMC is currently working with the State to develop an enforceable schedule to meet the proposed limitations.

IV. EFFLUENT MONITORING REQUIREMENTS

In addition to providing water quality-based limits, monitoring requirements must be included in the permit to determine compliance with effluent limitations (section 308 of the CWA and 40 CFR Part 122.44[i]). Additional monitoring may also be required to gather data for future effluent limitations or to monitor effluent impacts on receiving water quality. Internal effluent monitoring is being proposed in the draft permit because boiler blowdown is an auxiliary waste stream discharged through outfall 001. Since auxiliary waste streams are usually considered to be process water and have the potential to contain high concentrations of pollutants (e.g., metals), the internal monitoring parameters proposed in the draft permit include metals, hardness, and pH. The permittee is responsible for conducting the monitoring and for reporting results to EPA, IDEQ and the Shoshone-Bannock Tribes.

Monitoring frequencies are based on the nature and effect of the pollutant, as well as a determination of the minimum sampling necessary to adequately monitor the facility's performance. Table IV-1 presents the effluent monitoring requirements for the draft permit and Table IV-2 presents the internal monitoring requirements. For comparison purposes, the table also shows the monitoring requirements of the current permit.

TABLE IV-1: EFFLUENT MONITORING REQUIREMENTS				
PARAMETER	UNITS	SAMPLE FREQUENCY		SAMPLE TYPE
		CURRENT PERMIT (1982)	DRAFT PERMIT (2000)	
Ammonia, total as N	µg/L	not required	1/week	24-hour composite
Arsenic (As), total	µg/L	not required	1/week	24-hour composite
Boron (B), total	mg/L	not required	1/week	24-hour composite
Cadmium (Cd), total	µg/L	not required	1/week	24-hour composite
Chlorine, total residual	µg/L	not required	1/week	grab
Chromium (Cr), total	µg/L	not required	1/week	24-hour composite
Chemical Oxygen Demand	mg/L	not required	1/week	24-hour composite
Copper (Cu), total	µg/L	not required	1/week	24-hour composite
Cyanide (WAD)	µg/L	not required	1/week	grab
Dissolved Oxygen	mg/L	not required	1/week	grab
Flow	mgd	continuous	continuous	recording
Fluoride (F), total	mg/L	not required	1/week	24-hour composite
Gross Alpha Radiation	pCi/L	not required	1/week	grab
Hardness as $CaCO_3$	mg/L	not required	1/week	24-hour composite
Mercury (Hg), total	ng/L	not required	1/week	24-hour composite
Nitrate+Nitrite as N	mg/L	not required	1/week	24-hour composite
Orthophosphate as P	µg/L	not required	1/week	24-hour composite
Oil and Grease, total	mg/L	not required	1/week	grab
Phenols	mg/L	not required	1/week	grab
Phosphorus (P_4), elemental	µg/L	not required	1/week	grab
Phosphorus, total as P	mg/L	not required	1/week	24-hour composite
pH	s.u.	not required	1/week	grab
Radium-226 + Radium-228	pCi/L	not required	1/week	grab
Selenium (Se), total	µg/L	not required	1/week	24-hour composite
Silver (Ag), total	µg/L	not required	1/week	24-hour composite
Temperature	EC	continuous	continuous	recording
Thallium (Tl), total	µg/L	not required	1/week	24-hour composite
Whole Effluent Toxicity	TUc	not required	1/quarter[1]	24-hour composite
Zinc (Zn), total	µg/L	not required	1/week	24-hour composite

1 If no toxicity is determined, monitoring is only required during the first and fourth years.

TABLE IV-2: INTERNAL MONITORING REQUIREMENTS				
PARAMETER	UNITS	SAMPLE FREQUENCY		SAMPLE TYPE
		CURRENT PERMIT (1982)	DRAFT PERMIT (2000)	
Arsenic (As), total	µg/L	not required	1/week	grab
Boron (B), total	mg/L	not required	1/week	grab
Cadmium (Cd), total	µg/L	not required	1/week	grab
Chromium (Cr), total	µg/L	not required	1/week	grab
Copper (Cu), total	µg/L	not required	1/week	grab
Flow	mgd	not required	1/week	grab
Hardness as $CaCO_3$	mg/L	not required	1/week	grab
pH	s.u.	not required	1/week	grab
Selenium (Se), total	µg/L	not required	1/week	grab
Silver (Ag), total	µg/L	not required	1/week	grab
Thallium (Tl), total	µg/L	not required	1/week	grab
Zinc (Zn), total	µg/L	not required	1/week	grab

V. AMBIENT MONITORING

A. Water Monitoring

The purpose of water quality monitoring of the receiving (ambient) water body is to determine water quality conditions as part of the effort to evaluate the reasonable potential for the discharge to cause an instream excursion above water quality criteria (40 CFR part 122.44). Upstream monitoring is necessary to obtain the appropriate data to use in reasonable potential analysis (See equation 1 in Appendix C). Downstream monitoring is used to gain a better understanding of pollutant concentrations at the edge of the potential mixing zone in order to ensure that designated uses are being protected. The proposed ambient monitoring requirements for the draft permit are provided in Table V-1.

TABLE V-1: AMBIENT MONITORING REQUIREMENTS				
Parameter	Units	Sample Frequency	Sample Location	Sample Type
Ammonia, total as N	µg/L	1/month	upstream & downstream	grab
Arsenic (As), dissolved	µg/L	1/month	upstream & downstream	grab
Boron (B), total	mg/L	1/month	upstream & downstream	grab
Cadmium (Cd), dissolved	µg/L	1/month	upstream & downstream	grab
Chlorine, total residual	µg/L	1/month	upstream	grab
Chromium (Cr), dissolved	µg/L	1/month	upstream	grab
Chemical Oxygen Demand	mg/L	1/month	upstream & downstream	grab
Copper (Cu), dissolved	µg/L	1/month	upstream & downstream	grab
Dissolved Oxygen	mg/L	1/month	upstream & downstream	grab
Flow	mgd	1/week	upstream	grab
Fluoride (F), total	mg/L	1/month	upstream & downstream	grab
Gross Alpha Radiation	pCi/L	1/month	upstream	grab
Hardness as $CaCO_3$	mg/L	1/month	upstream	grab
Mercury (Hg), dissolved	ng/L	1/month	upstream & downstream	grab
Nitrate+Nitrite as N	mg/L	1/month	upstream & downstream	grab
Orthophosphate as P	µg/L	1/month	upstream & downstream	grab
pH	s.u.	1/month	upstream & downstream	grab
Phosphorus, total as P	µg/L	1/month	upstream & downstream	grab
Radium-226 + Radium-228	pCi/L	1/month	downstream	grab
Selenium (Se), total	µg/L	1/month	upstream & downstream	grab
Silver (Ag), dissolved	µg/L	1/month	upstream & downstream	grab
Temperature	EC	1/week	upstream	grab
Thallium (Tl), dissolved	µg/L	1/month	upstream & downstream	grab
Zinc (Zn), dissolved	µg/L	1/month	upstream & downstream	grab

B. Sediment Monitoring for Bioaccumulative Pollutants

In a letter from the U.S. Fish and Wildlife Service dated October 5, 1999, the Service expressed a concern about the increased potential for the accumulation of contaminants in the sediment and food chain organisms due to the authorization of a mixing zone. The draft permit proposes that the facility monitor for cadmium, mercury and selenium in the sediments near the outfall 001.

C. Notification of Permit Limit Exceedances

The permittee is required by 40 CFR 122.41 to provide 24-hour notice when there is an exceedance of a hazardous substance. By definition, a hazardous substance is any substance which presents an imminent and substantial danger to the public health and welfare, including but not limited to fish, shellfish, wildlife, beaches and shores. Since an exceedance of a hazardous substance limited in the permit would present a danger to public health and welfare, the draft permit proposes that the permittee notify the local district health office when there is an exceedance of a hazardous substance. Hazardous substances are noted in Table III-1 with a superscript 1 next to the parameter name.

VI. SPECIAL CONDITIONS

A. Quality Assurance Project Plan (QAPP)

Under 40 CFR Part 122.41(e), the permittee is required to ensure adequate laboratory controls and appropriate quality assurance procedures in order to properly operate and maintain all facilities which it uses. The current permit does not require the facility to develop a QAPP. The proposed permit requires the facility to develop and implement a QAPP within 90 days, review their plan at least every five years, and update the QAPP when applicable.

B. Best Management Practices (BMPs)

It is the national policy that, whenever feasible, pollution should be prevented or reduced at the source, that pollution which cannot be prevented should be recycled in an environmentally safe manner, that pollution which cannot be prevented or recycled should be treated in an environmentally safe manner, and that disposal or release into the environment should be employed only as a last resort and should be conducted in an environmentally safe manner (Pollution Prevention Act of 1990, 42 U.S.C. § 13101 et seq.). This policy and 40 CFR 122.44(k) form the basis for the draft permit requirement that the permittee develop and implement a BMPs operating plan.

BMPs are practices that are designed to minimize the volume of pollutants that must be treated. In developing its BMPs, the permittee will analyze all processes and activities at the facility to determine the potential for a release of pollutants due to that activity and ways to minimize that potential.

The draft permit requires that the permittee develop a plan and implement BMPs within 180 days after receiving authorization to discharge under this permit. Additionally, the BMP operating plan must be amended whenever there is a change in the facility or in the operation of the facility which materially increases the potential for an increased discharge of pollutants.

VII . OTHER LEGAL REQUIREMENTS

A. Endangered Species Act (ESA)

The Endangered Species Act (ESA) requires federal agencies to consult with the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) if the agency's actions could beneficially or adversely affect any threatened or endangered species. Therefore, EPA requested a listing of threatened or endangered species in the vicinity of the FMC Phosphorus Production Plant from NMFS and USFWS.

Letters from USFWS and NMFS dated September 18, 1998, and September 30, 1998, respectively, both indicated that there were no proposed, candidate or endangered anadromous fish species in the area of the proposed discharge. NMFS indicated that Snake River spring/summer and fall chinook salmon (Oncorhynchus tshawytscha), Snake River Sockeye salmon (Oncorhynchus nerka), and West Coast steelhead (Oncorhynchus mykiss) occur downstream in the Snake River basin below Hells Canyon Dam.

In a letter dated November 3, 1999, the US Fish and Wildlife Service (USFWS) identified the following federally-listed species in the area of discharge:

1. Endangered Species
   C Gray wolf (*Canis lupus*)
   • Ute ladies'-tresses (*Spiranthes diluvialis*)
2. Proposed Species
   none
3. Candidate Species
   C Pygmy rabbit (*Brachylagus idahoensis*)
   • Wolverine (*Gulo gulo luscus*)
   • Sage grouse (*Centrocercus urophasianus*)
   • Yellowstone cutthroat trout (*Oncorhynchus clarki bouvieri*)

At this time, EPA has determined that issuance of this permit is not likely to adversely affect any species in the vicinity of the discharge. In making this determination, EPA considered the following:

<u>Gray wolf</u>: Since the translocation of wolves from Canada, the population in Idaho south of Interstate Highway 90 is considered "experimental, non-essential" under section 10(j) of the Endangered Species Act.

<u>Ute ladies'-tresses</u>: This species has the potential to occur in wetland and riparian areas including springs, wet meadows, and river meanders. The species may be adversely affected by modification of riparian and wetland habitats associated

with livestock grazing, vegetation removal, excavation, construction for residential or commercial purposes, stream channelization, hydroelectric development and operation, and actions that alter hydrology.

Candidate species: Although these species have no status under the Endangered Species Act, EPA considers the species and their habitats in proposing federal actions. EPA has determined that there may be some effect to the Yellowstone cutthroat trout and has proposed some mitigating procedures in the proposed permit. These include sediment monitoring and no zone of dilution for selenium and mercury.

This fact sheet and the draft permit for the FMC Phosphorus Production Plant will be submitted to the USFWS and NMFS for review during the public notice period. EPA is requesting concurrence from the USFWS and NMFS on the impacts of the draft permit and will consider their comments in the final permit. EPA will re-evaluate this determination and initiate consultation should new information reveal impacts not previously considered during this determination.

B. State Certification

Since this permit authorized discharge to Idaho State waters, the provisions of Section 401 of the CWA apply. Section 401 of the CWA requires that states certify that federally issued permits are in compliance with state law. No permits can be issued until the requirements of this section are satisfied.

EPA is requesting Idaho State officials to review and provide appropriate certification to this draft NPDES permit pursuant to 40 CFR Part 124.53. Furthermore, in accordance with 40 CFR Part 124.10(c)(1), public notice of the draft permit has been provided to the state of Idaho agencies having jurisdiction over fish, shellfish, and wildlife resources.

C. Permit Expiration

This permit will expire five years from the effective date of the permit.

D. Facility Changes or Alterations

The facility is required to notify EPA, IDEQ and the Shoshone-Bannock Tribes of any planned physical alteration or operational change to the facility in accordance with 40 CFR 122.41(1). This requirement has been incorporated into the proposed permit to insure that EPA, IDEQ and the Shoshone-Bannock Tribes are notified of any potential increases or changes in the amount of pollutants being discharged. This will allow evaluation of the impact of the pollutant loading on the receiving water.

VIII. REFERENCES

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APPENDIX A

PROCESS DESCRIPTION

I. MANUFACTURING PROCESS

FMC produces approximately 250 million pounds of elemental phosphorus (white phosphorus) from about 1.4 million tons of phosphorus-containing shale ore per year. Elemental phosphorus is manufactured by the reduction of phosphate ore by coke in very large electric furnaces, using silica as a flux.

FMC mines and transports the shale ore to the facility where it is crushed, sized, and stockpiled. The process of phosphorus production is conducted in a three part process consisting of phosphate ore preparation, smelting in the electric furnace, and recovery of phosphorus. (See Figure A-1: Process Flow Diagram.)

A. Phosphate Ore Preparation

The phosphorus ore is washed and blended so that the furnace feed is of uniform composition. The ore is then dried and pressed into briquets using a continuous roll press and then sent to two continuous-grate kilns where the briquets are calcined into hardened “nodules”. In the calcining process, the briquets are heated to its fusion point at temperatures ranging from 1,800 to 2,500EF and uniformly sized for more efficient heat transfer in the furnace. The sizing produces fines and dust that are recycled to the briquetting process. The calcining process also creates fumes from water, organic matter, carbon dioxide and fluorine. These fumes are scrubbed with water in primary and secondary scrubbers to remove the fluorine gasses as HF and H_2SiF_6.

B. Electric Furnace Operations

FMC uses four electric arc furnaces to extract the phosphorus from the ore. The nodules, coke, and sand (silica) are fed to each furnace by incrementally adding weighted quantities of these materials onto a conveyor belt. Penetrations in the furnace are for feed chutes, carbon electrodes, tap holes, slag (upper liquid layer), ferrophosphorus (lower liquid layer), and exhaust gases (CO and P_4). The furnace operates at temperatures up to 2,700EF to extract the phosphorus from the ore. The slag and ferrophosphorus are air cooled, broken into large chunks and stockpiled onsite.

There are numerous sources of fumes from the furnace operation. The feeding operation is a source of dust, and fumes are emitted from the electrode penetrations and tapping operations. The fumes, consisting of dust, phosphorus vapor, and carbon monoxide, are collected and scrubbed.

C. Recovery of Phosphorus

The hot furnace exhaust gases pass through an electrostatic precipitator to remove the dust prior to phosphorus condensation. The dust is slurried with water and pumped to a settling pond where the solids are recycled to the raw feed for recovery of phosphates and the clarified pond effluent is reused in the slurrying operation.

Downstream of the precipitator, the phosphorus is condensed in primary and secondary condensers using a hot water spray. The liquid phosphorus drains into a water sump where the water maintains a seal from the atmosphere. The water is partially neutralized with lime to minimize corrosion and then recirculated from the sump to the condensers. The condenser exhaust gasses are mainly carbon monoxide which is burned in a flare or utilized for heating elsewhere in the plant.

The liquid phosphorus is routed to the Phos dock for collection and storage for shipment. Liquid phosphorus is stored in steam-heated tanks under a water blanket and pumped to tank cars prior to shipping. The tank cars also have a protective blanket of water and are equipped with steam coils for remelting at the destination.

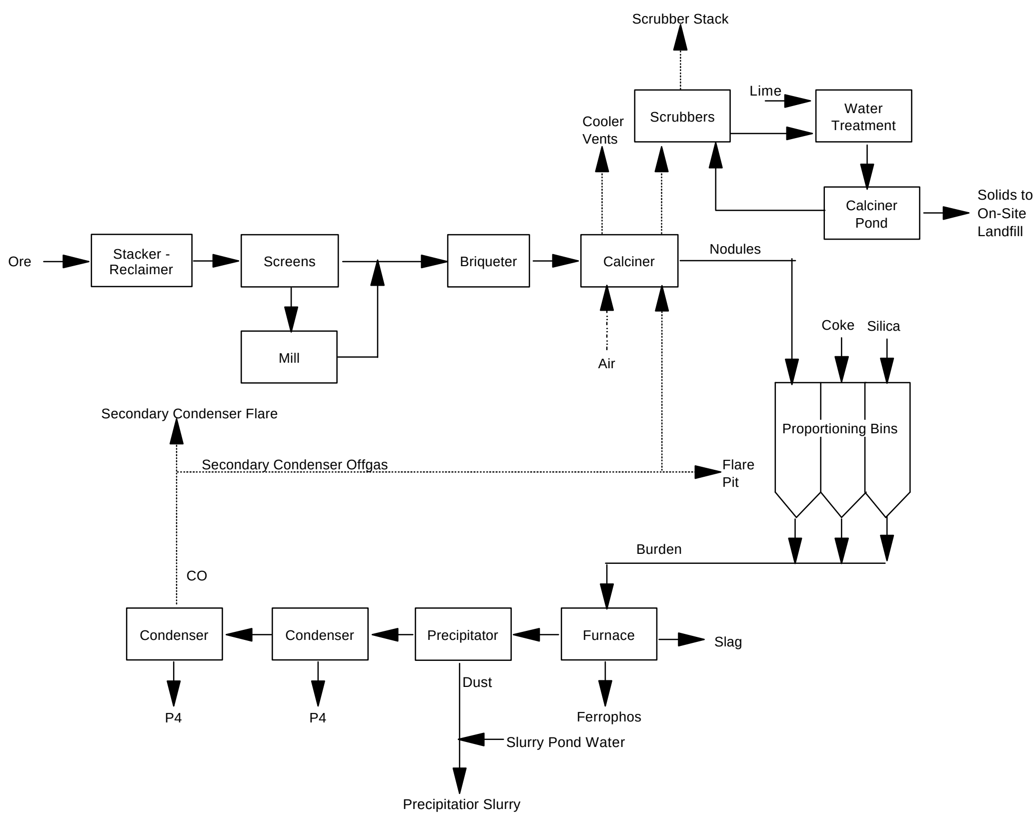

Figure A-1. Process Flow Diagram for FMC Corporation's Phosphorus Production Plant

II. WATER BALANCE

A. Specific Water Uses

Water is primarily used for the following purposes:

- Process Water
  - Product Water
  - Transport Water
  - Contact Cooling Water
  - Atmospheric Seal Water
  - Scrubber Water
  - Auxiliary Process Water
- Non-Contact Cooling Water
- Miscellaneous Uses
- Potable and Sanitary Uses

The plant water balance shown in Figure A-2 is based upon a typical outfall rate of 1,800 gallons per minute (gpm).

<u>Process Water</u>. One of the principal water uses in the phosphorus derived chemicals industry is process water. Direct use of water in the process normally results in the discharge of process waste water. The term "process waste water" means any water that, during manufacturing or processing, comes into direct contact with or results from the production or use of any raw material, intermediate product, finished product, by-product, or waste product. Process water is not discharged to the NPDES outfall.

> <u>Product Water</u>. Product water is water added to a product during manufacture. Product water comes in contact with the product and remains with the product as an integral part. Product water is not discharged to the NPDES outfall.
>
> <u>Transport Water</u>. Water used to transport reactants or products between unit operations (i.e., transferring liquid phosphorus to holding tanks, transferring precipitator dust in slurry to settling ponds). Intimate contact between the process materials and transport water usually occurs. Since transport water is used to facilitate manufacture, it is considered a type of process water. Transport water commonly picks up reactants or products in the suspended or dissolved form. Transport water is not discharged to the NPDES outfall.
>
> <u>Contact Cooling Water</u>. Contact cooling water is considered process water because it is utilized in the manufacturing process and makes direct

contact with process chemicals or materials. Contact cooling water commonly becomes contaminated with reagents, product, and byproducts. The main sources of this water are from the condensation of the gaseous phosphorus after it is produced in the furnaces and water used to quench the slag from the furnaces. Other uses include pump or compressor seal water, and furnace electrode seal water. Contact cooling water is process water and is not discharged to the NPDES outfall.

Atmospheric Seal Water. Atmospheric seal water is used to prevent phosphorus from coming into contact with air since it is highly reactive and can spontaneously ignite upon contact with the oxygen in air. Therefore, water is used to seal reaction vessels and as a water blanket on liquid phosphorus. Atmospheric seal water is process water and is not discharged to the NPDES outfall.

Scrubber Water. Water scrubbers are used to remove process vapors and dusts from stacks, tail gases, and gaseous process streams. The used scrubber water is regarded as process water since it was used in the manufacturing process and may contain byproducts. Scrubber water is not discharged to the NPDES outfall.

Auxiliary Process Water. This water is used in auxiliary plant operations such as makeup water to boilers with resultant boiler blowdown, equipment washing, storage and shipping container washing, and spill and leak wash down. The volume of wastewater from these operations is generally low in quantity, but highly concentrated in effluents. Auxiliary process water is not discharged to the NPDES outfall.

Non-Contact Cooling Water. The term “noncontact cooling water” means water used for cooling that does not come into direct contact with any raw material, intermediate product, waste product, or finished product. This wastewater consists of the following water streams in the plant:

- Non-contact cooling water from the calciner area including water beam cooling and fan bearing cooling waters;
- Non-contact cooling water from the furnace area including furnace dome, shell, and tapping hole cooling waters; and
- Steam condensate collected from various sources throughout the plant.

The makeup water for all of these non-process waste waters is groundwater from on-site production wells. A portion of the non-contact cooling water is recycled back to the plant as cooling water while the majority is discharged to the NPDES outfall. The flow rate to the outfall is variable, ranging from 780 gpm to 2,070 gpm. The variation is due to the use of the effluent for landscape irrigation and road watering during the summer months. The effluent is cooled 2 to 5EF using an evaporative spray fountain located in the IWW pond.

It is estimated that the contributions to the outfall flow are:

Non-contact cooling water (1771 gpm)
Boiler blowdown water (8 gpm)
Steam condensate water (21 gpm)

Miscellaneous Water Uses. These water uses include floor washing and cleanup, safety showers, eye wash stations, and equipment cleaning for maintenance purposes.

Potable and Sanitary Uses. Water used for drinking and sanitary purposes becomes sanitary wastewater. The sanitary wastewater system discharges to the Pocatello publicly Owned Treatment Works and is not discharged to the NPDES outfall.

B. Storm water

Only storm water associated with the industrial activity is managed by the facility. This includes precipitation that falls on storage piles, ponds, roads, parking lots and processing equipment. The majority of storm water from these areas is collected in a storm water pond which remains in balance through evaporation and percolation. The remainder of storm water from these areas is collected and used in the scrubber water system or process water system. No storm water is discharged to the NPDES outfall.

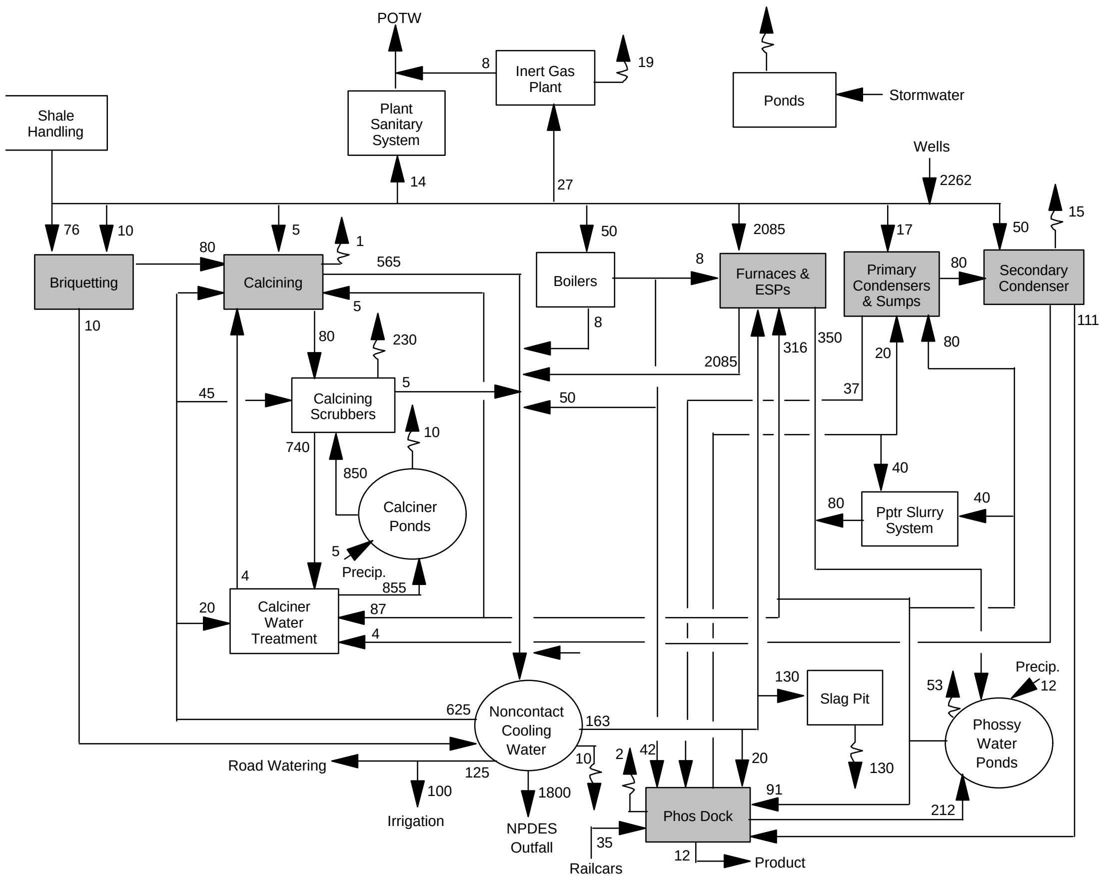

Figure A-2. Water Balance Diagram for FMC Corporation's Phosphorus Production Plant

APPENDIX B

MAP

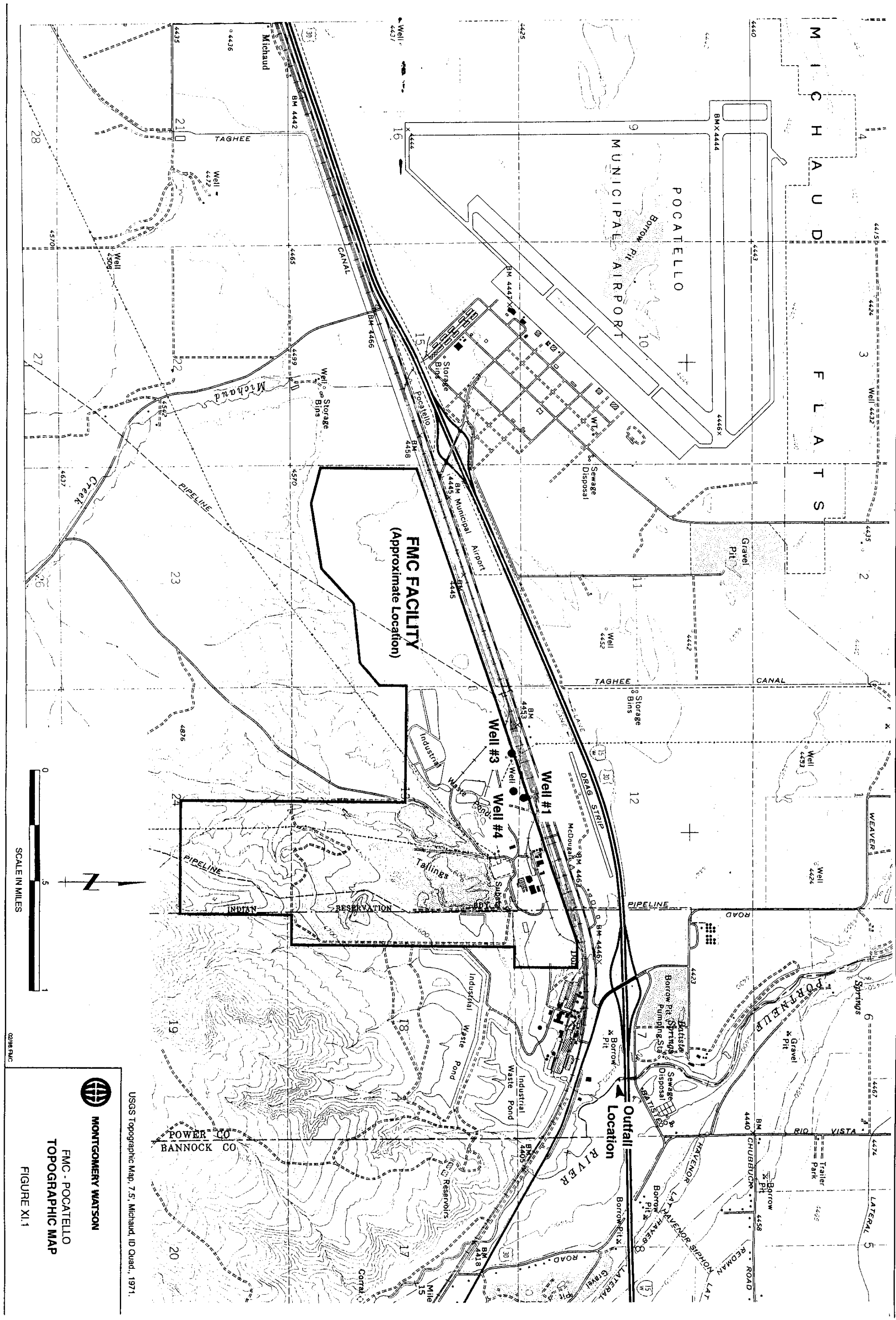

Figure B-1. Location of Facility and Outfall.

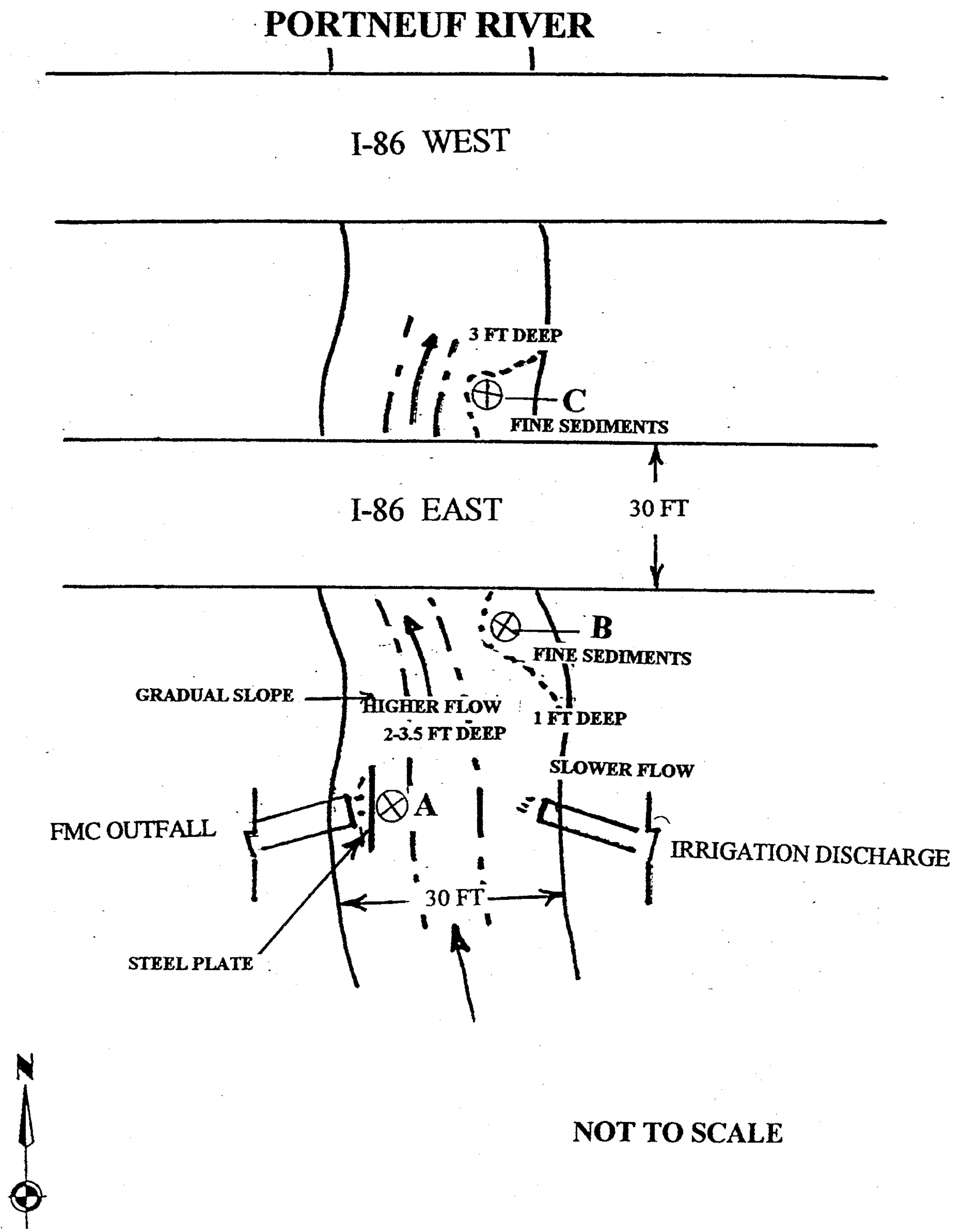

Figure B-2. Location of Outfall and Sediment Monitoring Sites.

APPENDIX C

CALCULATIONS

Calculations used to determine reasonable potential to violate water quality standards and develop permit limits were derived from EPA's Technical Support Document (EPA, 1991). For most pollutants, a model spreadsheet was used to perform the necessary calculations, however, others still required "hand calculations" be conducted. This appendix is comprised of the following: Section 1 provides the data used to perform the necessary calculations; Section 2 presents the calculations used in the model spreadsheet; and Section 3 contains any other calculations ("hand calculations").

This section discusses the calculations used in this spreadsheet model to determine reasonable potential, determine a wasteload allocation, and develop permit limits. In determining reasonable potential and water quality-based permit limits, this spreadsheet uses the steady-state model represented by the following equation:

$$Q_d C_d = Q_e C_e + Q_u C_u \qquad \text{[eqn. 1]}$$

where Q_d is the downstream receiving water flow (Q_e+Q_u), C_d is the downstream receiving water concentration, Q_e is the effluent flow, C_e is the effluent concentration, Q_u is the critical upstream receiving water flow with the allowed mixing, and C_u is the upstream receiving water concentration.

The critical upstream receiving water flow (Q_u) is dependant upon the critical flow and the allowed mixing:

$$Q_u = \left[critical \quad flow\right]\left[allowed \quad mixing\right]. \qquad \text{[eqn. 2]}$$

The critical flows for the different criteria are: the 7Q10 flow is used when applying the chronic criterion, the 1Q10 is used when applying the acute criterion, the harmonic mean is used when applying the human health or agriculture carcinogenic criterion, and the 30Q5 is used when applying the human health or agriculture non-carcinogenic criterion.

The allowed mixing is either a percent of the critical flow or a dilution ratio (dilution:1), where dilution is expressed as:

$$dilution = \frac{Q_d}{Q_e} = \frac{\left(Q_e + \left[critical \quad flow\right]\left[allowed \quad mixing\right]\right)}{Q_e}. \qquad \text{[eqn. 3]}$$

Since Q_u is dependant upon the critical flow and the allowed mixing, equation 3 can then be rearranged to determine Q_u:

$$Q_u = \left[critical \quad flow\right]\left[allowed \quad mixing\right] = dilution \cdot Q_e - Q_e. \qquad \text{[eqn. 4]}$$

If the upstream concentration (C_u) exceeds the water quality criteria for a particular pollutant, then the allowed mixing equals zero thus making the upstream flow (Q_u) equal to zero.

DETERMINING REASONABLE POTENTIAL

To determine reasonable potential, equation 1 is rearranged to solve for the projected downstream receiving water concentration (C_d):

$$C_d = \frac{\left(Q_e C_e + Q_u C_u\right)}{Q_d}. \qquad \text{[eqn. 5]}$$

In equation 5, C_e is derived using EPA's statistical approach in the following equation:

$$C_e = \frac{MEC \cdot RPM}{translator} \qquad \text{[eqn. 6]}$$

where MEC is the maximum effluent concentration, and RPM is the reasonable potential multiplier.

The RPM converts the MEC to the upper bounds of a lognormal distribution using a statistical analysis of the data set. The RPM is calculated in two parts. In the first part, the percentile (p_n) represented by the highest concentration in the data is computed using the following equation:

$$p_n = \left(1 - confidence\,level\right)^{1/n} \qquad \text{[eqn. 7]}$$

where the confidence level is 99 percent (0.99) and n is the number of data points. Then the reasonable potential multiplier (RPM) is determined from a relationship between the percentile and the selected upper bound of the lognormal effluent distribution. This relationship is given in the following equation:

$$RPM = \frac{C_{99}}{C_{p_n}} = \frac{\exp\left(2.326s - 0.5s^2\right)}{\exp\left(zs - 0.5s^2\right)} \qquad \text{[eqn. 8]}$$

where C_{99} is the statistical variability at an upper bound of 99 percent, C_{pn} is the statistical variability at the percentile (p_n), z is the statistical z-score at the percentile, $F^2=\ln(CV^2+1)$, and CV is the ratio of the standard deviation to the mean. The RPM is then multiplied by the MEC to obtain the projected maximum value of effluent concentration (C_e):

$$C_e = MEC \cdot RPM\ . \qquad \text{[eqn. 9a]}$$

For criteria expressed as dissolved, a translator is necessary to compare total recoverable data with the dissolved criteria. A translator is the fraction of total recoverable metal in the downstream water that is dissolved. Default translators are the inverse of the conversion factor associated with the criteria. The state of Idaho has default translators for arsenic, cadmium, chromium(III), chromium(VI), copper, lead, mercury, nickel, silver, and zinc, however, site specific translators can be used in lieu of the default translators. When a translator is used, equation 9a is modified to:

$$C_e = \frac{RMP \cdot MEC}{translator}\,. \qquad \text{[eqn. 9b]}$$

Once C_e is determined, equation 5 can be used to project the downstream concentration (C_d). This projected downstream concentration is then compared to each criterion to determine if there may be an exceedance of the water quality standard. If there is reasonable potential, then a water quality-based permit limit is computed.

DETERMINING A WASTELOAD ALLOCATION

The wasteload allocation (WLA) is used to determine the level of effluent concentration that would comply with water quality standards in the receiving water. A WLA is determined only for parameters that have a reasonable potential to cause an exceedance of water quality standards. WLAs based on protecting aquatic life will have two results: acute and chronic requirements because Idaho water quality standards provide both acute and chronic protection for aquatic life. In contrast, WLAs based on protecting human health and agriculture will have only a chronic requirement. To determine WLAs, equation 1 is rearranged to solve for C_e:

$$WLA = C_e = \frac{C_d\left(Q_e + Q_u\right) - C_u Q_u}{Q_e}\,. \qquad \text{[eqn. 10a]}$$

In equation 10, the numeric criteria in the water quality standards are used as the desired downstream concentration (Q_d) to calculate effluent concentrations that would result in compliance with those standards.

For whole effluent toxicity (WET), the acute WLA is converted into an equivalent chronic WLA by multiplying the acute WLA by an acute-to-chronic ratio (ACR). The ACR is the relationship between acute toxicity and chronic toxicity ($ACR = LC_{50}/NOEC$). In this case, equation 10a is modified to:

$$WLA_{ac} = C_e \cdot ACR = \frac{C_d\left(Q_e + Q_u\right) - C_u Q_u}{Q_e} \cdot ACR\,. \qquad \text{[eqn. 10b]}$$

DERIVING A PERMIT LIMIT

AQUATIC LIFE

The WLA for aquatic life provides two numbers for protection against two types of toxic effects: acute and chronic. These requirements yield different effluent treatment requirements that cannot be compared to each other without calculating the long-term average (LTA) performance level the plant would need to maintain in order to meet each requirement. The acute LTA is calculated using the following equation:

$$LTA_{a,c} = WLA_a \cdot e^{[0.5\sigma - z\sigma]} \qquad \text{[eqn. 11]}$$

where σ^2=ln(CV^2+1) and z=2.326 for the 99th percentile probability basis. Likewise, the chronic LTA is calculated as follows:

$$LTA_c = WLA_c \cdot e^{[0.5\sigma_4^2 - z\sigma_4]} \qquad \text{[eqn. 12]}$$

where σ_4^2=ln(CV^2/4+1) and z=2.326 for the 99th percentile probability basis. Once the acute and chronic LTAs are computed, they are compared and the lowest one is selected for permit limit development since it is protective of both acute and chronic WLAs.

The NPDES regulations at 40 CFR Part 122.45(d) require that all permit limits be expressed, unless impracticable, as both average monthly limits (AMLs) and maximum daily limits (MDLs) for all discharges other than POTWs, and as average weekly limits (AWLs) and AMLs for POTWs. In lieu of an AWL for POTWs, EPA recommends establishing an MDL for water quality-based permitting to account for acute toxicity impacts. Therefore, the MDL and AML are computed as follows:

$$MDL = LTA \cdot e^{[z\sigma - 0.5\sigma^2]} \qquad \text{[eqn. 13]}$$

$$AML = LTA \cdot e^{[z\sigma_n - 0.5\sigma_n^2]} \qquad \text{[eqn. 14]}$$

where σ^2=ln(CV^2+1), σ_n^2=ln(CV^2/n+1), n is the number of samples required per month, and z=1.645 for the 95th percentile probability basis.

Equations 13 and 14 provide limits based on concentration, however the NPDES regulations at 40 CFR Part 122.45(f) require that all pollutants limited in permit shall have limitations expressed in terms of mass except for pH, temperature, radiation, or other pollutants which cannot appropriately be expressed by mass. Thus, the MDL and AML must be converted to mass loadings, when applicable, as follows:

$$\text{Maximum Daily Loading} = MDL \cdot Q_e \cdot 8.34 \quad \text{(lb/day)} \qquad \text{[eqn. 15]}$$

Average Monthly Loading = AML·Q_e·8.34 (lb/day) [eqn. 16]

where Q_e is in units of million gallons per day (mgd) and 8.34 is a conversion factor.

HUMAN HEALTH & AGRICULTURE

Determining permit limits for pollutants affecting human health is somewhat different from setting limits for other pollutants because the exposure period is generally longer than one month. If the procedures used for aquatic life protection were applied in the development of permit limits for human health pollutants, both MDLs and AMLs would exceed the WLA. Therefore, the AML is set equal to the WLA and the MDL is computed as follows:

$$MDL = AML \cdot \frac{e^{\left[z_m s - 0.5 s^2\right]}}{e^{\left[z_a s_n - 0.5 s_n^2\right]}} \qquad \text{[eqn. 17]}$$

where $F^2=\ln(CV^2+1)$, $F_n^2=\ln(CV^2/n+1)$, n is the number of samples required per month, z_m=2.326 for the 99th percentile probability basis, and z_a=1.645 for the 95th percentile probability basis. The MDL and AML are then converted to mass loadings, when appropriate, using equations 15 and 16.

Flow Conditions

The flows used to evaluate compliance with the criteria are:

C The 1 day, 10 year low flow (1Q10) is used for the protection of aquatic life from acute effects. It represents the lowest daily flow that is expected to occur once in 10 years.

C The 7 day, 10 year low flow (7Q10) is used for the protection of aquatic life from chronic effects. It the lowest 7 day average flow expected to occur once in 10 years.

C The 30 day, 5 year low flow (30Q5) is used for the protection of human health from non-carcinogens. It represents the 30 day average flow expected to occur once in 5 years. For the period April 1 through September 30, the 30Q5 is also used for protection of agriculture.

C The harmonic mean flow is a long-term average flow and is used for the protection of human health from carcinogens. It is the number of daily flow measurements divided by the sum of the reciprocals of the flows. The harmonic mean was also used for the protection of agriculture year round.

The following table provides the flow information from the USGS gaging station at Pocatello that was used for reasonable potential analysis:

1Q10 (cfs)	7Q10 (cfs)	30Q5 (cfs)	Harmonic Mean (cfs)
6.92	13.19	34.88	122

SECTION 1 - CALCULATIONS FROM MODEL SPREADSHEET

NPDES Permit Number	ID-000022-1	Effluent Flow	3.07 mgd
Facility Name	FMC	1Q10	16.09 mgd
Outfall Number	001	7Q10	20.66 mgd
Receiving Water Body	Portneuf River	30Q5	33.53 mgd
		Harmonic Mean	87.10 mgd

Pollutant		Total Residual Chlorine		Cyanide (WAD)		fluoride		Aluminum		Antimony	
Maximum Effluent Conc.		4.00E-002	mg/L		mg/L	6.10E+001	mg/L	7.66E+000	mg/L	1.28E+000	mg/L
Upstream Conc. (Dissolved)	(For metals only)		mg/L		mg/L		mg/L		mg/L		mg/L
Upstream Conc. (TR)		3.10E-001	mg/L	0.00E+000	mg/L	3.47E-001	mg/L	8.62E-001	mg/L	1.21E-001	mg/L
Hardness (CaCO3)	acute	168	mg/L	209	mg/L	168	mg/L	168	mg/L	168	mg/L
	chronic	168	mg/L	213	mg/L	213	mg/L	168	mg/L	168	mg/L
Translator	acute	1		1		1		1		1	
	chronic	1		1		1		1		1	
CV		0.6		0.6		0.6		0.6		0.6	
Allowed Mixing		0	%	25	%	25	%	100	%	0	%
WER		1		1		1		1		1	
Monthly Sample Frequency		4		4		4		4		4	
Criteria Values											
Acute Aquatic Life		1.90E-002	mg/L	2.20E-002	mg/L	2.00E-001	mg/L	NA	mg/L	NA	mg/L
Chronic Aquatic Life		1.10E-002	mg/L	5.20E-003	mg/L	1.50E+000	mg/L	NA	mg/L	NA	mg/L
Human Health Recreation		NA	mg/L	2.20E+002	mg/L	NA	mg/L	NA	mg/L	4.30E+000	mg/L
Domestic Water Supply		NA	mg/L	7.00E-001	mg/L	NA	mg/L	NA	mg/L	1.40E-002	mg/L
Agriculture (livestock)		NA	mg/L	NA	mg/L	2.00E+003	mg/L	5.00E+000	mg/L	NA	mg/L
Agriculture (irrigation)		NA	mg/L	NA	mg/L	NA	mg/L	5.00E+000	mg/L	NA	mg/L
Most Limiting Criterion		Chronic Aquatic Life		Chronic Aquatic Life		Acute Aquatic Life		Agriculture (irrigation)		Human Health Recreation	
Calculations											
Reasonable Potential Mult.	RPM=C99/Cpn=exp(2.326*s-0.5*s^2)/exp(z*s-0.5*s^2)	2.80				2.10		2.26		2.26	
Max Proj. Effluent Conc.	Ce=max conc. * RPM / translator	1.12E-001	mg/L		mg/L	1.30E+002	mg/L	1.73E+001	mg/L	2.90E+000	mg/L
Max Proj. RW Conc.	Cd=(QeCe+QuCu)/(Qd)	1.12E-001	mg/L		mg/L	1.30E+002	mg/L	2.24E+000	mg/L	2.90E+000	mg/L
Waste Load Allocation	WLA=Ce = (CdQd - CuQu)/Qe	1.10E-002	mg/L		mg/L	2.00E-001	mg/L	NC	mg/L	NC	mg/L
Long Term Average (aquatic life only)	LTAa=WLA*exp(0.5*s^2-z*s) or LTAc=WLA*exp(0.5*s4^2-z*s4)	5.80E-003	mg/L		mg/L	6.42E-002	mg/L		mg/L		mg/L
Limits											
Maximum Daily Limit	MDL=LTA*exp(z*s-0.5*s^2) or MDL=AML*exp(zm*s-0.5*s^2)/exp(za*sn-0.5*sn^2)	1.81E-002	mg/L	2.29E-002	mg/L	2.00E-001	mg/L	No RP	mg/L	No RP	mg/L
Maximum Daily Loading	Lmd=MDL*Qe*8.34	4.63E-001	lbs/day	5.87E-001	lbs/day	5.12E+000	lbs/day		lbs/day		lbs/day
Average Monthly Limit	AML=LTA*exp(z*sn-0.5*sn^2) or AML=WLA	9.01E-003	mg/L	1.14E-002	mg/L	9.97E-002	mg/L	No RP	mg/L	No RP	mg/L
Average Monthly Loading	Lam=AML*Qe*8.34	2.31E-001	lbs/day	2.92E-001	lbs/day	2.55E+000	lbs/day		lbs/day		lbs/day

Notes:

C99	effluent concentration at 99th percentile
Cpn	effluent concentration at nth percentile
s^2	ln(CV^2+1)
z	z-score
Ce	effluent concentration
Cd	downstream concentration=water quality criteria
Qe	effluent flow rate
Qu	upstream flow rate
Cu	upstream concentration
s4^2	ln(CV^2/4+1)
sn^2	ln(CV^2/n+1)
n	number samples required per month
NC	non-carcinogen
C	carcinogen
WER	water effect ratio
CV	coefficient of variation
TR	total recoverable
RW	receiving water

NPDES Permit Number	ID-000022-1	Effluent Flow	3.07	mgd
Facility Name	FMC	1Q10	16.09	mgd
Outfall Number	001	7Q10	20.66	mgd
Receiving Water Body	Portneuf River	30Q5	33.53	mgd
		Harmonic Mean	87.10	mgd

Pollutant		Arsenic		Beryllium		Boron		Cadmium		Chromium, total	
Maximum Effluent Conc.		1.76E+000	mg/L	4.20E-003	mg/L	4.53E+000	mg/L	3.41E-002	mg/L	6.30E-003	mg/L
Upstream Conc. (Dissolved)	(For metals only)	0.00E+000	mg/L		mg/L		mg/L	3.38E-001	mg/L		mg/L
Upstream Conc. (TR)		7.62E-003	mg/L	3.36E-003	mg/L	2.37E-001	mg/L	0.00E+000	mg/L	3.50E-003	mg/L
Hardness (CaCO3)	acute	209	mg/L	168	mg/L	168	mg/L	209	mg/L	209	mg/L
	chronic	213	mg/L	168	mg/L	168	mg/L	213	mg/L	213	mg/L
Translator	acute	1		1		1		1		1	
	chronic	1		1		1		1		1	
CV		0.6		0.6		0.6		0.6		0.6	
Allowed Mixing		25	%	0	%	100	%	25	%	25	%
WER		1		1		1		1		1	
Monthly Sample Frequency		4		4		4		4		4	
Criteria Values											
Acute Aquatic Life		3.60E-001	mg/L	NA	mg/L	NA	mg/L	8.22E-003	mg/L	1.02E+000	mg/L
Chronic Aquatic Life		1.90E-001	mg/L	NA	mg/L	NA	mg/L	1.80E-003	mg/L	3.42E-001	mg/L
Human Health Recreation		5.00E-002	mg/L	NA	mg/L	NA	mg/L	NA	mg/L	NA	mg/L
Domestic Water Supply		5.00E-002	mg/L	NA	mg/L	NA	mg/L	NA	mg/L	NA	mg/L
Agriculture (livestock)		2.00E-001	mg/L	NA	mg/L	5.00E+000	mg/L	5.00E-002	mg/L	NA	mg/L
Agriculture (irrigation)		1.00E-001	mg/L	1.00E-001	mg/L	7.50E-001	mg/L	1.00E-002	mg/L	NA	mg/L
Most Limiting Criterion		Chronic Aquatic Life		Agriculture (livestock)		Agriculture (irrigation)		Chronic Aquatic Life		Chronic Aquatic Life	
Calculations											
Reasonable Potential Mult.	RPM=C99/Cpn=exp(2.326*s-0.5*s^2)/exp(z*s-0.5*s^2)	2.03		2.10		2.35		2.05		2.10	
Max Proj. Effluent Conc.	Ce=max conc. * RPM / translator	3.57E+000	mg/L	8.83E-003	mg/L	1.06E+001	mg/L	7.00E-002	mg/L	1.33E-002	mg/L
Max Proj. RW Conc.	Cd=(QeCe+QuCu)/(Qd)	1.34E+000	mg/L	8.83E-003	mg/L	1.16E+000	mg/L	2.38E-001	mg/L	4.32E-003	mg/L
Waste Load Allocation	WLA=Ce = (CdQd - CuQu)/Qe	4.97E-001	mg/L	NC	mg/L	1.36E+001	mg/L	1.80E-003	mg/L	NC	mg/L
Long Term Average (aquatic life only)	LTAa=WLA*exp(0.5*s^2-z*s) or LTAc=WLA*exp(0.5*s4^2-z*s4)	2.62E-001	mg/L		mg/L		mg/L	9.51E-004	mg/L		mg/L
Limits											
Maximum Daily Limit	MDL=LTA*exp(z*s-0.5*s^2) or MDL=AML*exp(zm*s-0.5*s^2)/exp(za*sn-0.5*sn^2)	5.16E-001	mg/L	No RP	mg/L	2.73E+001	mg/L	2.98E-003	mg/L	No RP	mg/L
Maximum Daily Loading	Lmd=MDL*Qe*8.34	2.09E+001	lbs/day		lbs/day	6.99E+002	lbs/day	7.58E-002	lbs/day		lbs/day
Average Monthly Limit	AML=LTA*exp(z*sn-0.5*sn^2) or AML=WLA	4.07E-001	mg/L	No RP	mg/L	1.36E+001	mg/L	1.48E-003	mg/L	No RP	mg/L
Average Monthly Loading	Lam=AML*Qe*8.34	1.04E+001	lbs/day		lbs/day	3.48E+002	lbs/day	3.78E-002	lbs/day		lbs/day

Notes:

C99	effluent concentration at 99th percentile
Cpn	effluent concentration at nth percentile
s^2	ln(CV^2+1)
z	z-score
Ce	effluent concentration
Cd	downstream concentration=water quality criteria
Qe	effluent flow rate
Qu	upstream flow rate
Cu	upstream concentration
s4^2	ln(CV^2/4+1)
sn^2	ln(CV^2/n+1)
n	number samples required per month
NC	non-carcinogen
C	carcinogen
WER	water effect ratio
CV	coefficient of variation
TR	total recoverable
RW	receiving water

NPDES Permit Number	ID-000022-1	Effluent Flow	3.07 mgd
Facility Name	FMC	1Q10	16.09 mgd
Outfall Number	001	7Q10	20.66 mgd
Receiving Water Body	Portneuf River	30Q5	33.53 mgd
		Harmonic Mean	87.10 mgd

Pollutant		Barium		Chromium (III)		Chromium (VI)		Cobalt		Copper	
Maximum Effluent Conc.		2.70E-001	mg/L	6.30E-003	mg/L	6.30E-003	mg/L	2.70E-002	mg/L	1.63E-001	mg/L
Upstream Conc. (Dissolved)	(For metals only)		mg/L	1.00E-004	mg/L	1.00E-004	mg/L		mg/L	3.47E-002	mg/L
Upstream Conc. (TR)		1.25E-001	mg/L	3.50E-003	mg/L	3.50E-003	mg/L	0.00E+000	mg/L	9.70E-003	mg/L
Hardness (CaCO3)	acute	168	mg/L	168	mg/L	209	mg/L	168	mg/L	209	mg/L
	chronic	168	mg/L	168	mg/L	213	mg/L	168	mg/L	213	mg/L
Translator	acute	1		3.16		1.02		1		1.04	
	chronic	1		1.16		1.04		1		1.04	
CV		0.6		0.6		0.6		0.6		0.6	
Allowed Mixing		0	%	0	%	25	%	100	%	25	%
WER		1		1		1		1		1	
Monthly Sample Frequency		4		4		4		4		4	
Criteria Values											
Acute Aquatic Life		NA	mg/L	8.39E-001	mg/L	1.60E-002	mg/L	NA	mg/L	3.41E-002	mg/L
Chronic Aquatic Life		5.00E+001	mg/L	2.72E-001	mg/L	1.10E-002	mg/L	NA	mg/L	2.17E-002	mg/L
Human Health Recreation		NA	mg/L	NA	mg/L	NA	mg/L	NA	mg/L	NA	mg/L
Domestic Water Supply		NA	mg/L	NA	mg/L	NA	mg/L	NA	mg/L	NA	mg/L
Agriculture (livestock)		NA	mg/L	1.00E+000	mg/L	1.00E+000	mg/L	1.00E+000	mg/L	5.00E-001	mg/L
Agriculture (irrigation)		NA	mg/L	1.00E-001	mg/L	1.00E-001	mg/L	5.00E-002	mg/L	2.00E-001	mg/L
Most Limiting Criterion		Chronic Aquatic Life		Agriculture (irrigation)		Chronic Aquatic Life		Agriculture (irrigation)		Acute Aquatic Life	
Calculations											
Reasonable Potential Mult.	RPM=C99/Cpn=exp(2.326*s-0.5*s^2)/exp(z*s-0.5*s^2)	2.26		2.10		2.10		2.30		2.08	
Max Proj. Effluent Conc.	Ce=max conc. * RPM / translator	6.11E-001	mg/L	1.33E-002	mg/L	1.33E-002	mg/L	6.22E-002	mg/L	3.26E-001	mg/L
Max Proj. RW Conc.	Cd=(QeCe+QuCu)/(Qd)	6.11E-001	mg/L	1.33E-002	mg/L	4.32E-003	mg/L	5.22E-003	mg/L	1.55E-001	mg/L
Waste Load Allocation	WLA=Ce = (CdQd - CuQu)/Qe	NC	mg/L	NC	mg/L	NC	mg/L	NC	mg/L	3.45E-002	mg/L
Long Term Average (aquatic life only)	LTAa=WLA*exp(0.5*s^2-z*s) or LTAc=WLA*exp(0.5*s4^2-z*s4)		mg/L		mg/L		mg/L		mg/L	1.11E-002	mg/L
Limits											
Maximum Daily Limit	MDL=LTA*exp(z*s-0.5*s^2) or MDL=AML*exp(zm*s-0.5*s^2)/exp(za*sn-0.5*sn^2)	No RP	mg/L	No RP	mg/L	No RP	mg/L	No RP	mg/L	3.45E-002	mg/L
Maximum Daily Loading	Lmd=MDL*Qe*8.34		lbs/day		lbs/day		lbs/day		lbs/day	8.84E-001	lbs/day
Average Monthly Limit	AML=LTA*exp(z*sn-0.5*sn^2) or AML=WLA	No RP	mg/L	No RP	mg/L	No RP	mg/L	No RP	mg/L	1.72E-002	mg/L
Average Monthly Loading	Lam=AML*Qe*8.34		lbs/day		lbs/day		lbs/day		lbs/day	4.41E-001	lbs/day

Notes:

C99	effluent concentration at 99th percentile
Cpn	effluent concentration at nth percentile
s^2	ln(CV^2+1)
z	z-score
Ce	effluent concentration
Cd	downstream concentration=water quality criteria
Qe	effluent flow rate
Qu	upstream flow rate
Cu	upstream concentration
s4^2	ln(CV^2/4+1)
sn^2	ln(CV^2/n+1)
n	number samples required per month
NC	non-carcinogen
C	carcinogen
WER	water effect ratio
CV	coefficient of variation
TR	total recoverable
RW	receiving water

NPDES Permit Number	ID-000022-1	Effluent Flow	3.07 mgd
Facility Name	FMC	1Q10	16.09 mgd
Outfall Number	001	7Q10	20.66 mgd
Receiving Water Body	Portneuf River	30Q5	33.53 mgd
		Harmonic Mean	87.10 mgd

Pollutant		Iron		Lithium		Manganese		Mercury		Molybdenum	
Maximum Effluent Conc.		4.99E+000	mg/L	1.60E+000	mg/L	1.87E-001	mg/L	1.30E-004	mg/L	1.80E-002	mg/L
Upstream Conc. (Dissolved)	(For metals only)		mg/L		mg/L		mg/L	2.85E-001	mg/L		mg/L
Upstream Conc. (TR)		6.47E-001	mg/L	5.38E-002	mg/L	5.18E-002	mg/L	1.06E-001	mg/L	0.00E+000	mg/L
Hardness (CaCO3)	acute	168	mg/L	168	mg/L	168	mg/L	168	mg/L	168	mg/L
	chronic	168	mg/L	168	mg/L	168	mg/L	168	mg/L	168	mg/L
Translator	acute	1		1		1		1.18		1	
	chronic	1		1		1		1		1	
CV		0.6		0.6		2.4		0.6		0.6	
Allowed Mixing		100	%	100	%	100	%	0	%	100	%
WER		1		1		1		1		1	
Monthly Sample Frequency		4		4		4		4		4	
Criteria Values											
Acute Aquatic Life		NA	mg/L	NA	mg/L	NA	mg/L	2.00E-003	mg/L	NA	mg/L
Chronic Aquatic Life		NA	mg/L	NA	mg/L	NA	mg/L	1.20E-005	mg/L	NA	mg/L
Human Health Recreation		NA	mg/L	NA	mg/L	NA	mg/L	1.50E-004	mg/L	NA	mg/L
Domestic Water Supply		NA	mg/L	NA	mg/L	NA	mg/L	1.40E-004	mg/L	NA	mg/L
Agriculture (livestock)		NA	mg/L	NA	mg/L	NA	mg/L	1.00E-002	mg/L	NA	mg/L
Agriculture (irrigation)		5.00E+000	mg/L	2.50E+000	mg/L	2.00E-001	mg/L	NA	mg/L	1.00E-002	mg/L
Most Limiting Criterion		Agriculture (livestock)		Agriculture (livestock)		Agriculture (livestock)		Chronic Aquatic Life		Agriculture (livestock)	
Calculations											
Reasonable Potential Mult.	RPM=C99/Cpn=exp(2.326*s-0.5*s^2)/exp(z*s-0.5*s^2)	2.30		2.35		8.00		2.08		2.35	
Max Proj. Effluent Conc.	Ce=max conc. * RPM / translator	1.15E+001	mg/L	3.75E+000	mg/L	1.50E+000	mg/L	2.70E-004	mg/L	4.22E-002	mg/L
Max Proj. RW Conc.	Cd=(QeCe+QuCu)/(Qd)	1.56E+000	mg/L	3.64E-001	mg/L	1.73E-001	mg/L	2.70E-004	mg/L	3.54E-003	mg/L
Waste Load Allocation	WLA=Ce = (CdQd - CuQu)/Qe	NC	mg/L	NC	mg/L	NC	mg/L	1.20E-005	mg/L	NC	mg/L
Long Term Average (aquatic life only)	LTAa=WLA*exp(0.5*s^2-z*s) or LTAc=WLA*exp(0.5*s4^2-z*s4)		mg/L		mg/L		mg/L	6.33E-006	mg/L		mg/L
Limits											
Maximum Daily Limit	MDL=LTA*exp(z*s-0.5*s^2) or MDL=AML*exp(zm*s-0.5*s^2)/exp(za*sn-0.5*sn^2)	No RP	mg/L	No RP	mg/L	No RP	mg/L	1.97E-005	mg/L	No RP	mg/L
Maximum Daily Loading	Lmd=MDL*Qe*8.34		lbs/day		lbs/day		lbs/day	5.05E-004	lbs/day		lbs/day
Average Monthly Limit	AML=LTA*exp(z*sn-0.5*sn^2) or AML=WLA	No RP	mg/L	No RP	mg/L	No RP	mg/L	9.82E-006	mg/L	No RP	mg/L
Average Monthly Loading	Lam=AML*Qe*8.34		lbs/day		lbs/day		lbs/day	2.52E-004	lbs/day		lbs/day

Notes:

C99	effluent concentration at 99th percentile
Cpn	effluent concentration at nth percentile
s^2	ln(CV^2+1)
z	z-score
Ce	effluent concentration
Cd	downstream concentration=water quality criteria
Qe	effluent flow rate
Qu	upstream flow rate
Cu	upstream concentration
s4^2	ln(CV^2/4+1)
sn^2	ln(CV^2/n+1)
n	number samples required per month
NC	non-carcinogen
C	carcinogen
WER	water effect ratio
CV	coefficient of variation
TR	total recoverable
RW	receiving water

NPDES Permit Number	ID-000022-1	Effluent Flow	3.07 mgd
Facility Name	FMC	1Q10	16.09 mgd
Outfall Number	001	7Q10	20.66 mgd
Receiving Water Body	Portneuf River	30Q5	33.53 mgd
		Harmonic Mean	87.10 mgd

Pollutant			Nickel		Selenium		Silver		Thallium		Vanadium	
Maximum Effluent Conc.			1.80E-002	mg/L	4.22E+000	mg/L	3.50E-002	mg/L	3.18E-001	mg/L	8.30E-002	mg/L
Upstream Conc. (Dissolved)	(For metals only)		0.00E+000	mg/L		mg/L	2.55E-003	mg/L		mg/L		mg/L
Upstream Conc. (TR)			1.36E-002	mg/L	2.95E-003	mg/L		mg/L	0.00E+000	mg/L	3.77E-003	mg/L
Hardness (CaCO3)		acute	168	mg/L	168	mg/L	209	mg/L	168	mg/L	168	mg/L
		chronic	168	mg/L	168	mg/L	168	mg/L	168	mg/L	168	mg/L
Translator		acute	1		1		1.18		1		1	
		chronic	1		1		1		1		1	
CV			0.6		0.6		0.6		0.6		0.6	
Allowed Mixing			0	%	0	%	25	%	100	%	100	%
WER			1		1		1		1		1	
Monthly Sample Frequency			4		4		4		4		4	
Criteria Values												
Acute Aquatic Life			2.20E+000	mg/L	2.00E-002	mg/L	1.22E-002	mg/L	NA	mg/L	NA	mg/L
Chronic Aquatic Life			2.44E-001	mg/L	5.00E-003	mg/L	NA	mg/L	NA	mg/L	NA	mg/L
Human Health Recreation			4.60E+000	mg/L	NA	mg/L	NA	mg/L	6.30E-003	mg/L	NA	mg/L
Domestic Water Supply			6.10E-001	mg/L	NA	mg/L	NA	mg/L	1.70E-003	mg/L	NA	mg/L
Agriculture (livestock)			NA	mg/L	5.00E-002	mg/L	NA	mg/L	NA	mg/L	1.00E-001	mg/L
Agriculture (irrigation)			2.00E-001	mg/L	2.00E-002	mg/L	NA	mg/L	NA	mg/L	1.00E-001	mg/L
Most Limiting Criterion			Agriculture (livestock)		Chronic Aquatic Life		Acute Aquatic Life		Human Health Recreation		Agriculture (irrigation)	
Calculations												
Reasonable Potential Mult.	RPM=C99/Cpn=exp(2.326*s-0.5*s^2)/exp(z*s-0.5*s^2)		2.35		2.16		2.08		2.23		2.13	
Max Proj. Effluent Conc.	Ce=max conc. * RPM / translator		4.22E-002	mg/L	9.11E+000	mg/L	9.64E-003	mg/L	7.08E-001	mg/L	1.77E-001	mg/L
Max Proj. RW Conc.	Cd=(QeCe+QuCu)/(Qd)		4.22E-002	mg/L	9.11E+000	mg/L	2.40E-002	mg/L	2.41E-002	mg/L	1.83E-002	mg/L
Waste Load Allocation	WLA=Ce = (CdQd - CuQu)/Qe		NC	mg/L	5.00E-003	mg/L	3.00E-002	mg/L	1.85E-001	mg/L	NC	mg/L
Long Term Average (aquatic life only)	LTAa=WLA*exp(0.5*s^2-z*s) or LTAc=WLA*exp(0.5*s4^2-z*s4)			mg/L	2.64E-003	mg/L	9.64E-003	mg/L		mg/L		mg/L
Limits												
Maximum Daily Limit	MDL=LTA*exp(z*s-0.5*s^2) or MDL=AML*exp(zm*s-0.5*s^2)/exp(za*sn-0.5*sn^2)		No RP	mg/L	8.21E-003	mg/L	3.00E-002	mg/L	3.71E-001	mg/L	No RP	mg/L
Maximum Daily Loading	Lmd=MDL*Qe*8.34			lbs/day	2.10E-001	lbs/day	7.69E-001	lbs/day	9.51E+000	lbs/day		lbs/day
Average Monthly Limit	AML=LTA*exp(z*sn-0.5*sn^2) or AML=WLA		No RP	mg/L	4.09E-003	mg/L	1.50E-002	mg/L	1.85E-001	mg/L	No RP	mg/L
Average Monthly Loading	Lam=AML*Qe*8.34			lbs/day	1.05E-001	lbs/day	3.83E-001	lbs/day	4.74E+000	lbs/day		lbs/day

Notes:

C99	effluent concentration at 99th percentile
Cpn	effluent concentration at nth percentile
s^2	ln(CV^2+1)
z	z-score
Ce	effluent concentration
Cd	downstream concentration=water quality criteria
Qe	effluent flow rate
Qu	upstream flow rate
Cu	upstream concentration
s4^2	ln(CV^2/4+1)
sn^2	ln(CV^2/n+1)
n	number samples required per month
NC	non-carcinogen
C	carcinogen
WER	water effect ratio
CV	coefficient of variation
TR	total recoverable
RW	receiving water

NPDES Permit Number	ID-000022-1	Effluent Flow	3.07 mgd
Facility Name	FMC	1Q10	16.09 mgd
Outfall Number	001	7Q10	20.66 mgd
Receiving Water Body	Portneuf River	30Q5	33.53 mgd
		Harmonic Mean	87.10 mgd

Pollutant			Zinc		Ammonia, total		Nitrate+Nitrite		Orthophosphate		Orthophosphate	
Maximum Effluent Conc.			5.25E+000	mg/L	3.00E-001	mg/L	1.84E+001	mg/L	2.21E+003	mg/L	7.00E-001	mg/L
Upstream Conc. (Dissolved)	(For metals only)		4.13E-002	mg/L		mg/L		mg/L		mg/L		mg/L
Upstream Conc. (TR)			7.27E-002	mg/L	0.00E+000	mg/L	1.30E+000	mg/L	2.84E-002	mg/L	2.84E-002	mg/L
Hardness (CaCO3)		acute	209	mg/L	168	mg/L	168	mg/L	168	mg/L	168	mg/L
		chronic	213	mg/L	168	mg/L	168	mg/L	168	mg/L	168	mg/L
Translator		acute	1.02		1		1		1		1	
		chronic	1.01		1		1		1		1	
CV			0.6		0.6		0.6		0.6		0.6	
Allowed Mixing			25	%	0	%	0	%	0	%	0	%
WER			1		1		1		1		1	
Monthly Sample Frequency			4		4		4		4		4	
Criteria Values												
Acute Aquatic Life			2.14E-001	mg/L	1.33E+000	mg/L	NA	mg/L	NA	mg/L	NA	mg/L
Chronic Aquatic Life			1.98E-001	mg/L	2.40E-001	mg/L	NA	mg/L	5.00E-002	mg/L	5.00E-004	mg/L
Human Health Recreation			NA	mg/L	NA	mg/L	NA	mg/L	NA	mg/L	NA	mg/L
Domestic Water Supply			NA	mg/L	NA	mg/L	NA	mg/L	NA	mg/L	NA	mg/L
Agriculture (livestock)			2.50E+001	mg/L	NA	mg/L	1.00E+002	mg/L	NA	mg/L	NA	mg/L
Agriculture (irrigation)			2.00E+000	mg/L	NA	mg/L	NA	mg/L	NA	mg/L	NA	mg/L
Most Limiting Criterion			Acute Aquatic Life		Chronic Aquatic Life		Agriculture (irrigation)		Chronic Aquatic Life		Chronic Aquatic Life	
Calculations												
Reasonable Potential Mult.	RPM=C99/Cpn=exp(2.326*s-0.5*s^2)/exp(z*s-0.5*s^2)		2.03		2.16		2.26		2.19		2.23	
Max Proj. Effluent Conc.	Ce=max conc. * RPM / translator		1.04E+001	mg/L	6.48E-001	mg/L	4.17E+001	mg/L	4.85E+003	mg/L	1.56E+000	mg/L
Max Proj. RW Conc.	Cd=(QeCe+QuCu)/(Qd)		4.45E+000	mg/L	6.48E-001	mg/L	4.17E+001	mg/L	4.85E+003	mg/L	1.56E+000	mg/L
Waste Load Allocation	WLA=Ce = (CdQd - CuQu)/Qe		4.48E-001	mg/L	2.40E-001	mg/L	NC	mg/L	5.00E-002	mg/L	5.00E-004	mg/L
Long Term Average (aquatic life only)	LTAa=WLA*exp(0.5*s^2-z*s) or LTAc=WLA*exp(0.5*s4^2-z*s4)		1.44E-001	mg/L	1.27E-001	mg/L		mg/L	2.64E-002	mg/L	2.64E-004	mg/L
Limits												
Maximum Daily Limit	MDL=LTA*exp(z*s-0.5*s^2) or MDL=AML*exp(zm*s-0.5*s^2)/exp(za*sn-0.5*sn^2)		4.48E-001	mg/L	3.94E-001	mg/L	No RP	mg/L	8.21E-002	mg/L	8.21E-004	mg/L
Maximum Daily Loading	Lmd=MDL*Qe*8.34		1.15E+001	lbs/day	1.01E+001	lbs/day		lbs/day	2.10E+000	lbs/day	2.10E-002	lbs/day
Average Monthly Limit	AML=LTA*exp(z*sn-0.5*sn^2) or AML=WLA		2.23E-001	mg/L	1.96E-001	mg/L	No RP	mg/L	4.09E-002	mg/L	4.09E-004	mg/L
Average Monthly Loading	Lam=AML*Qe*8.34		5.72E+000	lbs/day	5.03E+000	lbs/day		lbs/day	1.05E+000	lbs/day	1.05E-002	lbs/day

Notes:

C99	effluent concentration at 99th percentile
Cpn	effluent concentration at nth percentile
s^2	ln(CV^2+1)
z	z-score
Ce	effluent concentration
Cd	downstream concentration=water quality criteria
Qe	effluent flow rate
Qu	upstream flow rate
Cu	upstream concentration
s4^2	ln(CV^2/4+1)
sn^2	ln(CV^2/n+1)
n	number samples required per month
NC	non-carcinogen
C	carcinogen
WER	water effect ratio
CV	coefficient of variation
TR	total recoverable
RW	receiving water

NPDES Permit Number	ID-000022-1	Effluent Flow	1.98064516129032 mgd
Facility Name	FMC	1Q10	6.41 mgd
Outfall Number	001	7Q10	10.98 mgd
Receiving Water Body	Portneuf River	30Q5	23.85 mgd
		Harmonic Mean	79.35 mgd

Pollutant		Ammonia, total		Phosphorus, total		Phosphorus, total		Phosphorus, total		phenols	
Maximum Effluent Conc.		2.88E+002	mg/L	2.59E+003	mg/L	3.00E+000	mg/L		mg/L	2.00E-002	mg/L
Upstream Conc. (Dissolved)	(For metals only)		mg/L		mg/L		mg/L		mg/L		mg/L
Upstream Conc. (TR)		0.00E+000	mg/L	3.49E-001	mg/L	3.49E-001	mg/L	3.49E-001	mg/L	0.00E+000	mg/L
Hardness (CaCO3)	acute	168	mg/L	168	mg/L	168	mg/L	168	mg/L	168	mg/L
	chronic	168	mg/L	168	mg/L	168	mg/L	168	mg/L	168	mg/L
Translator	acute	1		1		1		1		1	
	chronic	1		1		1		1		1	
CV		0.6		5.3		1.1		1.1		0.6	
Allowed Mixing		0	%	0	%	0	%	0	%	0	%
WER		1		1		1		1		1	
Monthly Sample Frequency		4		4		4		4		4	
Criteria Values											
Acute Aquatic Life		1.33E+000	mg/L	NA	mg/L	NA	mg/L	NA	mg/L	1.02E+001	mg/L
Chronic Aquatic Life		2.40E-001	mg/L	1.00E-001	mg/L	1.00E-001	mg/L	1.00E-001	mg/L	2.56E+000	mg/L
Human Health Recreation		NA	mg/L	NA	mg/L	NA	mg/L	NA	mg/L	4.60E+003	mg/L
Domestic Water Supply		NA	mg/L	NA	mg/L	NA	mg/L	NA	mg/L	2.10E+001	mg/L
Agriculture (livestock)		NA	mg/L	NA	mg/L	NA	mg/L	NA	mg/L	NA	mg/L
Agriculture (irrigation)		NA	mg/L	NA	mg/L	NA	mg/L	NA	mg/L	NA	mg/L
Most Limiting Criterion		Chronic Aquatic Life		Chronic Aquatic Life		Chronic Aquatic Life		Chronic Aquatic Life		chronic, aquatic life	
Calculations											
Reasonable Potential Mult.	RPM=C99/Cpn=exp(2.326*s-0.5*s^2)/exp(z*s-0.5*s^2)	2.13		10.41		3.17		ERR		13.19	
Max Proj. Effluent Conc.	Ce=max conc. * RPM / translator	6.14E+002	mg/L	2.70E+004	mg/L	9.52E+000	mg/L		mg/L	2.64E-001	mg/L
Max Proj. RW Conc.	Cd=(QeCe+QuCu)/(Qd)	6.14E+002	mg/L	2.70E+004	mg/L	9.52E+000	mg/L		mg/L	2.64E-001	mg/L
Waste Load Allocation	WLA=Ce = (CdQd - CuQu)/Qe	2.40E-001	mg/L	1.00E-001	mg/L	1.00E-001	mg/L		mg/L	NC	mg/L
Long Term Average (aquatic life only)	LTAa=WLA*exp(0.5*s^2-z*s) or LTAc=WLA*exp(0.5*s4^2-z*s4)	1.27E-001	mg/L	9.87E-003	mg/L	3.45E-002	mg/L		mg/L		mg/L
Limits											
Maximum Daily Limit	MDL=LTA*exp(z*s-0.5*s^2) or MDL=AML*exp(zm*s-0.5*s^2)/exp(za*sn-0.5*sn^2)	3.94E-001	mg/L	1.31E-001	mg/L	1.84E-001	mg/L	1.84E-001	mg/L	No RP	mg/L
Maximum Daily Loading	Lmd=MDL*Qe*8.34	6.51E+000	lbs/day	2.16E+000	lbs/day	3.04E+000	lbs/day	3.04E+000	lbs/day		lbs/day
Average Monthly Limit	AML=LTA*exp(z*sn-0.5*sn^2) or AML=WLA	1.96E-001	mg/L	3.74E-002	mg/L	7.04E-002	mg/L	7.04E-002	mg/L	No RP	mg/L
Average Monthly Loading	Lam=AML*Qe*8.34	3.25E+000	lbs/day	6.18E-001	lbs/day	1.16E+000	lbs/day	1.16E+000	lbs/day		lbs/day

Notes:

C99	effluent concentration at 99th percentile
Cpn	effluent concentration at nth percentile
s^2	ln(CV^2+1)
z	z-score
Ce	effluent concentration
Cd	downstream concentration=water quality criteria
Qe	effluent flow rate
Qu	upstream flow rate
Cu	upstream concentration
s4^2	ln(CV^2/4+1)
sn^2	ln(CV^2/n+1)
n	number samples required per month
NC	non-carcinogen
C	carcinogen
WER	water effect ratio
CV	coefficient of variation
TR	total recoverable
RW	receiving water

NPDES Permit Number	ID-000022-1	Effluent Flow		3.07	mgd					
Facility Name	FMC	1Q10		16.09	mgd					
Outfall Number	001	7Q10		20.66	mgd					
Receiving Water Body	Portneuf River	30Q5		33.53	mgd					
		Harmonic Mean		87.10	mgd					
Pollutant		Gross Alpha Radiation		Radium226+Radium228		Gross Alpha Radiation		Radium226+Radium228		
Maximum Effluent Conc.		1.87E+002	pCi/L	6.50E+000	pCi/L	6.71E+000	pCi/L	1.95E+000	pCi/L	mg/L
Upstream Conc. (Dissolved)	(For metals only)		pCi/L		pCi/L		pCi/L		pCi/L	mg/L
Upstream Conc. (TR)		6.74E+000	pCi/L	1.57E+000	pCi/L	6.70E+000	pCi/L	1.57E+000	pCi/L	mg/L
Hardness (CaCO3)	acute									mg/L
	chronic									mg/L
Translator	acute	1		1		1		1		
	chronic	1		1		1		1		
CV		0.6		0.6		0.6		0.6		
Allowed Mixing		0	%	0	%	0	%	0	%	:1
WER		1		1		1		1		
Monthly Sample Frequency		4		4		4		4		
Criteria Values										
Acute Aquatic Life		NA	pCi/L	NA	pCi/L	NA	pCi/L	NA	pCi/L	mg/L
Chronic Aquatic Life		NA	pCi/L	NA	pCi/L	NA	pCi/L	NA	pCi/L	mg/L
Human Health Recreation		NA	pCi/L	NA	pCi/L	NA	pCi/L	NA	pCi/L	mg/L
Domestic Water Supply		NA	pCi/L	NA	pCi/L	NA	pCi/L	NA	pCi/L	mg/L
Agriculture (livestock)		1.50E+001	pCi/L	5.00E+000	pCi/L	1.50E+001	pCi/L	5.00E+000	pCi/L	mg/L
Agriculture (irrigation)		1.50E+001	pCi/L	5.00E+000	pCi/L	1.50E+001	pCi/L	5.00E+000	pCi/L	mg/L
Most Limiting Criterion		Agriculture (irrigation)		Agriculture (irrigation)		Agriculture (irrigation)		Agriculture (irrigation)		
Calculations										
Reasonable Potential Mult.	RPM=C99/Cpn=exp(2.326*s-0.5*s^2)/exp(z*s-0.5*s^2)	2.13		2.39		2.16		2.44		
Max Proj. Effluent Conc.	Ce=max conc. * RPM / translator	3.98E+002	pCi/L	1.56E+001	pCi/L	1.45E+001	pCi/L	4.76E+000	pCi/L	mg/L
Max Proj. RW Conc.	Cd=(QeCe+QuCu)/(Qd)	3.98E+002	pCi/L	1.56E+001	pCi/L	1.45E+001	pCi/L	4.76E+000	pCi/L	mg/L
Waste Load Allocation	WLA=Ce = (CdQd - CuQu)/Qe	1.50E+001	pCi/L	5.00E+000	pCi/L	NC	pCi/L	NC	pCi/L	mg/L
Long Term Average (aquatic life only)	LTAa=WLA*exp(0.5*s^2-z*s) or LTAc=WLA*exp(0.5*s4^2-z*s4)		pCi/L		pCi/L		pCi/L		pCi/L	mg/L
Limits										
Maximum Daily Limit	MDL=LTA*exp(z*s-0.5*s^2) or MDL=AML*exp(zm*s-0.5*s^2)/exp(za*sn-0.5*sn^2)	3.01E+001	pCi/L	1.00E+001	pCi/L	No RP	pCi/L	No RP	pCi/L	mg/L
Maximum Daily Loading	Lmd=MDL*Qe*8.34									lbs/day
Average Monthly Limit	AML=LTA*exp(z*sn-0.5*sn^2) or AML=WLA	1.50E+001	pCi/L	5.00E+000	pCi/L	No RP	pCi/L	No RP	pCi/L	mg/L
Average Monthly Loading	Lam=AML*Qe*8.34									lbs/day

Notes:

C99	effluent concentration at 99th percentile
Cpn	effluent concentration at nth percentile
s^2	ln(CV^2+1)
z	z-score
Ce	effluent concentration
Cd	downstream concentration=water quality criteria
Qe	effluent flow rate
Qu	upstream flow rate
Cu	upstream concentration
s4^2	ln(CV^2/4+1)
sn^2	ln(CV^2/n+1)
n	number samples required per month
NC	non-carcinogen
C	carcinogen
WER	water effect ratio
CV	coefficient of variation
TR	total recoverable
RW	receiving water

SECTION 2 - HAND CALCULATIONS

I. Lead-210

A. Reasonable Potential

criterion: 10 pCi/L
maximum effluent concentration (MEC) = 2.53 pCi/L
number of data points (n) = 10
percentile based on 99% confidence level (p_n) = $(1-.99)^{1/n}$ = 0.6310
z-score for percentile (z) = 0.33
coefficient of variation (CV) = (standard deviation ÷ mean) = 0.6
$F^2 = \ln(CV^2+1) = 0.31$
$F = 0.55$
reasonable potential multiplier (RPM) = $\frac{c_{99}}{c_{63}} = \frac{\exp\left(2.326s - 0.5s^2\right)}{\exp\left(zs - 0.5s^2\right)} = 3.0$
maximum projected effluent concentration (Ce) = (MEC)(RPM) = 7.6

Since projected effluent concentration of 7.6 pCi/L is less than the criterion of 10 pCi/L, lead-210 does not have the potential to violate the water quality standards.

B. Limits

N/A

II. Polonium-210

A. Reasonable Potential

criterion: 40 pCi/L
maximum effluent concentration (MEC) = 0.22 pCi/L
number of data points (n) = 10
percentile based on 99% confidence level (p_n) = $(1-.99)^{1/n}$ = 0.6310
z-score for percentile (z) = 0.33
coefficient of variation (CV) = (standard deviation ÷ mean) = 0.6
$F^2 = \ln(CV^2+1) = 0.31$
$F = 0.55$
reasonable potential multiplier (RPM) = $\frac{c_{99}}{c_{63}} = \frac{\exp\left(2.326s - 0.5s^2\right)}{\exp\left(zs - 0.5s^2\right)}$ =3.0
maximum projected effluent concentration (Ce) = (MEC)(RPM) = 0.66 pCi/L

Since the projected effluent concentration of 0.66 pCi/L is less than the criterion of 40 pCi/L, polonium-210 does not have the potential to violate the water quality standards.

B. Limits

N/A

III. Radium-226

A. Reasonable Potential

criterion: 60 pCi/L
maximum effluent concentration (MEC) = 0.141 pCi/L
number of data points (n) = 10
percentile based on 99% confidence level (p_n) = $(1-.99)^{1/n}$ = 0.6310
z-score for percentile (z) = 0.33
coefficient of variation (CV) = (standard deviation ÷ mean) = 0.9
$F^2 = \ln(CV^2+1) = 0.31$
F = 0.55

reasonable potential multiplier (RPM) = $\dfrac{c_{99}}{c_{63}} = \dfrac{\exp\left(2.326s - 0.5s^{2}\right)}{\exp\left(zs - 0.5s^{2}\right)}$ =3.0

maximum projected effluent concentration (Ce) = (MEC)(RPM) = 0.423 pCi/L

Since the projected effluent concentration of 0.423 pCi/L is less than the criterion of 60 pCi/L, radium-226 does not have the potential to violate the water quality standards.

B. Limits

N/A

IV. Radium-228

A. Reasonable Potential

criterion: 60 pCi/L
maximum effluent concentration (MEC) = 6.5 pCi/L
number of data points (n) = 10
percentile based on 99% confidence level (p_n) = $(1-.99)^{1/n}$ = 0.6310
z-score for percentile (z) = 0.33
coefficient of variation (CV) = (standard deviation ÷ mean) = 0.6
$F^2 = \ln(CV^2+1) = 0.31$
$F = 0.55$

reasonable potential multiplier (RPM) = $\frac{c_{99}}{c_{63}} = \frac{\exp\left(2.326s - 0.5s^2\right)}{\exp\left(zs - 0.5s^2\right)} = 3.0$

maximum projected effluent concentration (Ce) = (MEC)(RPM) = 19.5 pCi/L

Since the projected effluent concentration of 19.5 pCi/L is less than the criterion of 60 pCi/L, radium-228 does not have the potential to violate the water quality standards.

B. Limits

N/A

V. Turbidity

A. Reasonable Potential

criterion: <5 NTU increase over background (Cu)
background (Cu) = 41.5 NTU
Qu = (1Q10)(MZ) = 1.12 mgd
  river flow (1Q10) = 4.46 mgd
  mixing zone (MZ) = 25%
maximum effluent concentration (MEC) = 4.5 NTU
average annual effluent flow (Qe) = 2.28
number of data points (n) = 10
percentile based on 99% confidence level (p_n) = $(1-.99)^{1/n}$ = 0.6310
z-score for percentile (z) = 0.33
coefficient of variation (CV) = (standard deviation ÷ mean) = 1.2
$F^2 = \ln(CV^2+1) = 0.89$
F = 0.94

reasonable potential multiplier (RPM) = $\dfrac{c_{99}}{c_{63}} = \dfrac{\exp\left(2.326s - 0.5s^{2}\right)}{\exp\left(zs - 0.5s^{2}\right)}$ =6.5

maximum projected effluent concentration (Ce) = (MEC)(RPM) = 29.2 NTU

receiving water concentration (Cr) = $\dfrac{\left(Q_eC_e + Q_uC_u\right)}{\left(Q_e + Q_u\right)}$ = 33.3 NTU

Since the projected receiving water concentration of 33.3 NTU is less than the background concentration of 41.5 NTU, turbidity does not have the potential to violate the water quality standards.

B. Limits

N/A

VI. Temperature

Using first law of thermodynamics: $H=mC_p)T$ (C_p=1.0 BTU/lb/EF)
Assuming conservation of energy, heat lost in effluent equals heat gained in river:

$H_e=H_d$

$m_eC_p(T_e-T_u)=m_dC_p(T_d-T_u)$

Divide both sides by density (D_e=8.345 lb/gallon) and time to get flow (Q):

$Q_e(T_e-T_u)=Q_d(T_d-T_u)$ where $Q_d=Q_e+Q_u$

The final equation is:

$\mathbf{Q_eT_e+Q_uT_u=(Q_e+Q_u)T_d}$

A. Tier I (April 1 - July 31)

1. Reasonable Potential

$\mathbf{T_d=(Q_eT_e+Q_uT_u)\div(Q_e+Q_u)}$

a. Instantaneous Maximum

criterion (max. salmonid spawn.): 13EC
criterion (point source treatment): net increase <1.0EC (1.8EF)
outside mixing zone ($T_d=T_u$ +1.0=26EC)
maximum peak effluent flow (Qe) = 3.07 mgd
maximum daily effluent temperature (Te) = 33EC
background (Tu) = 25EC
Qu = (7Q10)(MZ) = 0 mgd
river flow (7Q10) = 11.5 mgd
mixing zone (MZ) = 0%

T_d = [(3.07)(33)+(0)(25)]÷(3.07+0)
T_d = 33EC

No mixing zone is allowed because the background temperature (Tu) exceeds the criteria for this time period. Since the projected downstream temperature exceeds the criterion, limits are needed and applied at the end of the pipe.

b. Maximum Daily

criterion (avg. salmonid spawn.): 9EC
criterion (point source treatment): net increase <1.0EC (1.8EF)
outside mixing zone (T_d=T_u+1.0=25EC)
average annual effluent flow (Qe) = 2.28 mgd
maximum average daily effluent temperature (Te) = 31EC
background (Tu) = 24EC
Qu = (7Q10)(MZ) = 0 mgd
river flow (7Q10) = 11.5 mgd
mixing zone (MZ) = 0%

T_d = [(2.28)(31)+(0)(24)]÷(2.28+0)
T_d = 31EC

No mixing zone is allowed because the background temperature (Tu) exceeds the criteria for this time period. Since the projected downstream temperature exceeds the criterion, limits are needed and applied at the end of the pipe.

2. Limits

$\mathbf{T_e=[T_d(Q_e+Q_u)-Q_uT_u]\div Q_e}$

a. Instantaneous Maximum

(1) Determine effluent limit using criterion for salmonid spawning (T_d=criterion)

T_e=[(13)(3.07+0)-(0)(25)]÷3.07
T_e = 13EC

(2) Determine effluent limit using criterion for point source treatment (T_d = T_u+1.0 = 26EC)

T_e=[(26)(3.07+0)-(0)(25)]÷3.07
T_e = 26EC

(3) Choose lowest limit

<u>T_e = 13EC</u>

b. Maximum Daily

(1) Determine effluent limit using criterion for salmonid spawning (T_d=criterion)

$T_e=[(9)(2.28+0)-(0)(24)]\div 2.28$
T_e = 9EC

(2) Determine effluent limit using criterion for point source treatment ($T_d = T_u+1.0$ = 26EC)

$T_e=[(25)(2.28+0)-(0)(24)]\div 2.28$
T_e = 25EC

(3) Choose lowest limit

<u>T_e = 9EC</u>

3. Loading

Since the effluent limitations equal the criteria for this time period, no thermal loading is allowed for this discharge.

B. Tier II (August 1 - September 30)

1. Reasonable Potential

$T_d=(Q_eT_e+Q_uT_u)\div(Q_e+Q_u)$

a. Instantaneous Maximum

criterion (max. aquatic life): 22EC
criterion (point source treatment): net increase <1.0EC (1.8EF)
outside mixing zone ($T_d=T_u+1.0=22$EC)
maximum peak effluent flow (Qe) = 3.07 mgd
maximum daily effluent temperature (Te) = 32EC
background (Tu) = 21EC
Qu = (7Q10)(MZ) = 4.6 mgd
river flow (7Q10) = 18.3 mgd
mixing zone (MZ) = 25%

T_d = [(3.07)(32)+(4.6)(21)]÷(3.07+4.6)
T_d = 25EC

Since the projected downstream temperature exceeds the criteria, limits are needed and applied at the end of the pipe.

b. Maximum Daily

criterion (avg. aquatic life): 19EC
criterion (point source treatment): net increase <1.0EC (1.8EF)
outside mixing zone ($T_d=T_u+1.0=22$EC)
average annual effluent flow (Qe) = 2.28 mgd
maximum average daily effluent temperature (Te) = 31EC
background (Tu) = 21EC
Qu = (7Q10)(MZ) = 0 mgd
river flow (7Q10) = 18.3 mgd
mixing zone (MZ) = 0%

T_d = [(2.28)(31)+(0)(21)]÷(2.28+0)
T_d = 31EC

No mixing zone is allowed because the background temperature (Tu) exceeds the criterion for this time period. Since the projected downstream temperature exceeds the criterion, limits are needed and applied at the end of the pipe.

2. Limits

T_e=[T_d(Q_e+Q_u)-$Q_u$$T_u$]÷$Q_e$

a. Instantaneous Maximum

(1) Determine effluent limit using criterion for aquatic life (T_d=criterion).

T_e=[(22)(3.07+4.6)-(4.6)(21)]÷3.07
T_e = 23EC

(2) Determine effluent limit using criterion for point source treatment (T_d=T_u+1EC)

T_e=[(22)(3.07+4.6)-(4.6)(21)]÷3.07
T_e = 23EC

(3) Choose lowest limit

T_e = 23EC

b. Maximum Daily

(1) Determine effluent limit using criterion for aquatic life (T_d=criterion).

T_e=[(19)(2.28+0)-(0)(21)]÷2.28
T_e = 19EC

(2) Determine effluent limit using criterion for point source treatment (T_d=T_u+1EC)

T_e=[(22)(2.28+0)-(0)(21)]÷2.28
T_e = 22EC

(3) Choose lowest limit

T_e = 19EC

3. Loading

Thermal loading can be accomplished by either limiting the flow or the temperature. Since the temperature is being limited, the thermal loading was computed as follows:

Maximum Daily

$\mathbf{H_e=m_eC_p(T_e-T_u)}$ = $Q_e(1x10^6)D_eC_p(T_e-T_u)$
$H_e = (2.28)(1x10^6)(8.345)(1.0)(89.6-69.8)$
$\underline{H_e = 3.8x10^8 \text{ BTU/day}}$

C. Tier III (October 1 - March 31)

1. Reasonable Potential

$\mathbf{T_d=(Q_eT_e+Q_uT_u)\div(Q_e+Q_u)}$

a. Instantaneous Maximum

criterion (max. aquatic life): 22EC
criterion (point source treatment): net increase <1.0EC (1.8EF)
outside mixing zone ($T_d=T_u+1.0=13$EC)
maximum peak effluent flow (Qe) = 3.07 mgd
maximum daily effluent temperature (Te) = 30EC
background (Tu) = 12EC
Qu = (7Q10)(MZ) = 12.5 mgd
river flow (7Q10) = 50 mgd
mixing zone (MZ) = 25%

$T_d = [(3.07)(30)+(12.5)(12)]\div(3.07+12.5)$
$T_d = 16$EC

Since the projected downstream temperature exceeds the criterion for point source treatment, limits are needed and applied at the end of the pipe.

b. Maximum Daily

criterion (avg. aquatic life): 19EC
criterion (point source treatment): net increase <1.0EC (1.8EF)
outside mixing zone (T_d=T_u+1.0=12EC)
average annual effluent flow (Qe) = 2.28 mgd
maximum average daily effluent temperature (Te) = 30EC
background (Tu) = 11EC
Qu = (7Q10)(MZ) = 12.5 mgd
river flow (7Q10) = 50 mgd
mixing zone (MZ) = 25%

T_d = [(2.28)(30)+(12.5)(11)]÷(2.28+12.5)
T_d = 14EC (57.2EF)

Since the projected downstream temperature exceeds the criterion for point source treatment, limits are needed and applied at the end of the pipe.

2. Limits

$\mathbf{T_e=[T_d(Q_e+Q_u)-Q_uT_u]\div Q_e}$

a. Instantaneous Maximum

(1) Determine effluent limit using criterion for aquatic life (T_d=criterion).

T_e=[(22)(3.07+12.5)-(12.5)(12)]÷3.07
T_e = 63EC

(2) Determine effluent limit using criterion for point source treatment (T_d=T_u+1EC)

T_e=[(13)(3.07+12.5)-(12.5)(12)]÷3.07
T_e = 17EC

(3) Choose lowest limit

<u>T_e = 17EC</u>

b. Maximum Daily

(1) Determine effluent limit using criterion for aquatic life (T_d=criterion).

T_e=[(19)(2.28+12.5)-(12.5)(11)]÷2.28
T_e = 63EC

(2) Determine effluent limit using criterion for point source treatment (T_d=T_u+1EC)

T_e=[(12)(2.28+12.5)-(12.5)(11)]÷2.28
T_e = 17EC

(3) Choose lowest limit

$\underline{T_e = 17EC}$

3. Loading

Thermal loading can be accomplished by either limiting the flow or the temperature. Since the temperature is being limited, the thermal loading was computed as follows:

Maximum Daily

$\mathbf{H_e=m_eC_p(T_e-T_u)}$ = $Q_e(1x10^6)D_eC_p(T_e-T_u)$
H_e = $(2.28)(1x10^6)(8.345)(1.0)(85.3-51.3)$
$\underline{H_e = 6.5x10^8 \text{ BTU/day}}$